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pour obtenir

le grade de Docteur en Mécanique

par

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## Explosion violente d'un fil rectiligne dans un écoulement. Application à l'hypersonique

### Résultats numériques

Jury:

Président:
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Monsieur DYMENT, Professeur à l'Université des Sciences et  Techniques de
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Monsieur VEUILLOT, Chef de Division à l'O.N.E.R.A Chatillon
Monsieur MERLEN, Docteur d'Etat et Ingénieur à l'I.M.F.L

soutenue le 12 Novembre 1990

# Avant propos

Le travail d'une recherche scientifique n'est jamais l'œuvre absolue de celui qui le présente. Si cette thèse a pu voir le jour c'est grâce aux aides, aux soutiens et aux conseils de très nombreuses personnes.

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┌─────────────────────────────────┐
│   Organigramme pour le calcul   │
│    de la solution de l'explosion │
└─────────────────────────────────┘


              ┌──────────────────────────────────┐
              │       entrée des données          │
              │  α, γ, pas, N(nombre de points)   │
              └──────────────────────────────────┘
                              │
              ┌──────────────────────────────────┐
              │    calcul de la solution de base  │
              │            (ordre 0)              │
              │   ξ, ξ₀, ξ₀', u₀, p₀, ρ₀          │
              │            u₀*, p₀*               │
              └──────────────────────────────────┘
```
$$\xi, \xi_0, \xi_0', u_0, p_0, \rho_0$$
$$u_0^*, p_0^*$$

┌──────────────────────────────────┐   ┌──────────────────────────────────┐
│   calcul de la solution pour      │   │   calcul de la solution pour      │
│ l'effet anisotrope d'ordre 1      │   │  l'effet de la contre-pression    │
│         du courant                │   │                                   │
│   $\xi_1, \beta, u_1, v_1, p_1, \rho_1$ │ │ $\xi_{22}, \xi_{22}', u_{22}, p_{22}, \rho_{22}$ │
│                                   │   │                                   │
│   $u_1^*, v_1^*, p_1^*, \rho_1^*$ │   │   $u_{22}^*, p_{22}^*, \rho_{22}^*$ │
└──────────────────────────────────┘   └──────────────────────────────────┘

┌──────────────────────────────────┐   ┌──────────────────────────────────┐
│   calcul de la solution pour      │   │   calcul de la solution pour      │
│  l'effet isotrope d'ordre 2       │   │ l'effet anisotrope d'ordre 2      │
│         du courant                │   │          du courant               │
│  $\xi_{23}, \xi_{23}', u_{23}, p_{23}, \rho_{23}$ │ │ $\xi_{21}, \xi_{21}', u_{21}, v_2, p_{21}, \rho_{21}$ │
│                                   │   │                                   │
│  $u_{23}^*, p_{23}^*, \rho_{23}^*$ │   │  $u_{21}^*, v_2^*, p_{21}^*, \rho_{21}^*$ │
└──────────────────────────────────┘   └──────────────────────────────────┘

# Résultats numériques sur l'explosion du fil

# Tableaux 1

## Valeurs des constantes pour l'explosion

### $\alpha = 0.0000$

|          | $\gamma = 1.33$ | $\gamma = 1.4$ | $\gamma = 1.67$ |
|----------|-----------------|----------------|-----------------|
| $\xi_0$    | 0.9548          | 1.0040         | 1.1554          |
| $\beta$    | 1.0000          | 1.0000         | 1.0000          |
| $\xi_{22}$ | 1.0000          | 0.9919         | 0.9696          |

Les coefficients $\xi_0'$, $\xi_1$, $\xi_{j=22,23,21}'$ et $\xi_{j=23,21}$ sont tous nuls.

### $\alpha = 0.6667$

|          | $\gamma = 1.33$ | $\gamma = 1.4$ | $\gamma = 1.67$ |
|----------|-----------------|----------------|-----------------|
| $\xi_0$     | 0.9377          | 0.9568         | 1.0238          |
| $\xi_0'$    | 0.8593          | 0.8387         | 0.7748          |
| $\xi_1$     | 0.0587          | 0.0656         | 0.0797          |
| $\beta$     | 0.5512          | 0.5457         | 0.5327          |
| $\xi_{22}$  | 0.5737          | 0.5710         | 0.5663          |
| $\xi_{22}'$ | $-0.5005$       | $-0.4764$      | $-0.4045$       |
| $\xi_{23}$  | 0.0770          | 0.0796         | 0.0901          |
| $\xi_{23}'$ | 0.0364          | 0.0362         | 0.0395          |
| $\xi_{21}$  | 0.0835          | 0.0819         | 0.0756          |
| $\xi_{21}'$ | 0.0694          | 0.0727         | 0.0859          |

### $\alpha = 1.0000$

|          | $\gamma = 1.33$ | $\gamma = 1.4$ | $\gamma = 1.67$ |
|----------|-----------------|----------------|-----------------|
| $\xi_0$     | 0.9014          | 0.9166         | 0.9708          |
| $\xi_0'$    | 0.8924          | 0.8751         | 0.8186          |
| $\xi_1$     | 0.0070          | 0.0077         | 0.0090          |
| $\beta$     | 0.5471          | 0.5442         | 0.5350          |
| $\xi_{22}$  | 0.4353          | 0.4360         | 0.4398          |
| $\xi_{22}'$ | $-0.4091$       | $-0.3913$      | $-0.3372$       |
| $\xi_{23}$  | 0.0719          | 0.0758         | 0.0898          |
| $\xi_{23}'$ | 0.0493          | 0.0495         | 0.0511          |
| $\xi_{21}$  | 0.0720          | 0.0704         | 0.0651          |
| $\xi_{21}'$ | 0.0942          | 0.0964         | 0.1034          |

$$\alpha = 1.2000$$

|  | $\gamma = 1.33$ | $\gamma = 1.4$ | $\gamma = 1.67$ |
|---|---|---|---|
| $\xi_0$ | 0.8797 | 0.8934 | 0.9425 |
| $\xi_0'$ | 0.9041 | 0.8880 | 0.8347 |
| $\xi_1$ | $-0.0061$ | $-0.0073$ | $-0.0116$ |
| $\beta$ | 0.5374 | 0.5352 | 0.5278 |
| $\xi_{22}$ | 0.3691 | 0.3713 | 0.3783 |
| $\xi_{22}'$ | $-0.3683$ | $-0.3525$ | $-0.3048$ |
| $\xi_{23}$ | 0.0689 | 0.0727 | 0.0868 |
| $\xi_{23}'$ | 0.0499 | 0.0503 | 0.0523 |
| $\xi_{21}$ | 0.0728 | 0.0709 | 0.0647 |
| $\xi_{21}'$ | 0.0942 | 0.0962 | 0.1029 |

$$\alpha = 1.4000$$

|  | $\gamma = 1.33$ | $\gamma = 1.4$ | $\gamma = 1.67$ |
|---|---|---|---|
| $\xi_0$ | 0.8588 | 0.8713 | 0.9164 |
| $\xi_0'$ | 0.9125 | 0.8974 | 0.8468 |
| $\xi_1$ | $-0.0139$ | $-0.0163$ | $-0.0244$ |
| $\beta$ | 0.5265 | 0.5248 | 0.5187 |
| $\xi_{22}$ | 0.3181 | 0.3208 | 0.3292 |
| $\xi_{22}'$ | $-0.3304$ | $-0.3167$ | $-0.2750$ |
| $\xi_{23}$ | 0.0652 | 0.0690 | 0.0828 |
| $\xi_{23}'$ | 0.0488 | 0.0493 | 0.0518 |
| $\xi_{21}$ | 0.0735 | 0.0715 | 0.0648 |
| $\xi_{21}'$ | 0.0931 | 0.0949 | 0.1011 |

$$\alpha = 1.6000$$

|  | $\gamma = 1.33$ | $\gamma = 1.4$ | $\gamma = 1.67$ |
|---|---|---|---|
| $\xi_0$ | 0.8389 | 0.8504 | 0.8921 |
| $\xi_0'$ | 0.9189 | 0.9047 | 0.8562 |
| $\xi_1$ | $-0.0186$ | $-0.0218$ | $-0.0326$ |
| $\beta$ | 0.5156 | 0.5141 | 0.5088 |
| $\xi_{22}$ | 0.2703 | 0.2740 | 0.2835 |
| $\xi_{22}'$ | $-0.3038$ | $-0.2911$ | $-0.2539$ |
| $\xi_{23}$ | 0.0626 | 0.0661 | 0.0796 |
| $\xi_{23}'$ | 0.0480 | 0.0487 | 0.0515 |
| $\xi_{21}$ | 0.0761 | 0.0740 | 0.0673 |
| $\xi_{21}'$ | 0.0941 | 0.0956 | 0.1015 |

## $\alpha = 1.8000$

|  | $\gamma = 1.33$ | $\gamma = 1.4$ | $\gamma = 1.67$ |
|---|---|---|---|
| $\xi_0$ | 0.8199 | 0.8306 | 0.8697 |
| $\xi_0'$ | 0.9240 | 0.9103 | 0.8638 |
| $\xi_1$ | $-0.0216$ | $-0.0253$ | $-0.0379$ |
| $\beta$ | 0.5050 | 0.5037 | 0.4990 |
| $\xi_{22}$ | 0.2338 | 0.2387 | 0.2487 |
| $\xi_{22}'$ | $-0.2788$ | $-0.2684$ | $-0.2324$ |
| $\xi_{23}$ | 0.0595 | 0.0627 | 0.0757 |
| $\xi_{23}'$ | 0.0466 | 0.0475 | 0.0502 |
| $\xi_{21}$ | 0.0779 | 0.0756 | 0.0689 |
| $\xi_{21}'$ | 0.0947 | 0.0964 | 0.1009 |

## $\alpha = 2.0000$

|  | $\gamma = 1.33$ | $\gamma = 1.4$ | $\gamma = 1.67$ |
|---|---|---|---|
| $\xi_0$ | 0.8019 | 0.8120 | 0.8488 |
| $\xi_0'$ | 0.9280 | 0.9149 | 0.8699 |
| $\xi_1$ | $-0.0230$ | $-0.0270$ | $-0.0406$ |
| $\beta$ | 0.4948 | 0.4936 | 0.4892 |
| $\xi_{22}$ | 0.2041 | 0.2065 | 0.2140 |
| $\xi_{22}'$ | $-0.2441$ | $-0.2335$ | $-0.2003$ |
| $\xi_{23}$ | 0.0483 | 0.0517 | 0.0642 |
| $\xi_{23}'$ | 0.0356 | 0.0367 | 0.0411 |
| $\xi_{21}$ | 0.0770 | 0.0748 | 0.0660 |
| $\xi_{21}'$ | 0.0927 | 0.0941 | 0.0990 |

# Tableaux 2

## Fonctions de Sakuraï

$$\gamma = 1.4$$

| $\xi$ | $\varphi_2$ | $\psi_2$ | $\chi_2$ |
|---|---|---|---|
| 1 | −5. | −0.1428 | −5 |
| 0.9965 | −4.9158 | −0.0218 | −4.5114 |
| 0.9929 | −4.8345 | 0.0890 | −4.0444 |
| 0.9893 | −4.7579 | 0.1877 | −3.6088 |
| 0.9857 | −4.6838 | 0.2774 | −3.1920 |
| 0.9820 | −4.6132 | 0.3575 | −2.7982 |
| 0.9783 | −4.5466 | 0.4278 | −2.4304 |
| 0.9745 | −4.4823 | 0.4905 | −2.0783 |
| 0.9707 | −4.4218 | 0.5447 | −1.7491 |
| 0.9668 | −4.3635 | 0.5921 | −1.4337 |
| 0.9628 | −4.3079 | 0.6325 | −1.1353 |
| 0.9589 | −4.2557 | 0.6659 | −0.8561 |
| 0.9548 | −4.2054 | 0.6936 | −0.5885 |
| 0.9507 | −4.1581 | 0.7152 | −0.3381 |
| 0.9464 | −4.1127 | 0.7316 | −0.0979 |
| 0.9421 | −4.0695 | 0.7428 | 0.1294 |
| 0.9378 | −4.0291 | 0.7491 | 0.3423 |
| 0.9333 | −3.9903 | 0.7509 | 0.5466 |
| 0.9287 | −3.9536 | 0.7483 | 0.7401 |
| 0.9241 | −3.9192 | 0.7417 | 0.9212 |
| 0.9193 | −3.8863 | 0.7312 | 1.0950 |
| 0.9144 | −3.8556 | 0.7172 | 1.2577 |
| 0.9094 | −3.8263 | 0.6996 | 1.4138 |
| 0.9042 | −3.7987 | 0.6787 | 1.5616 |
| 0.8989 | −3.7731 | 0.6550 | 1.7000 |

| $\xi$ | $\varphi_2$ | $\psi_2$ | $\chi_2$ |
|--------|--------|--------|--------|
| 0.8934 | −3.7487 | 0.6281 | 1.8327 |
| 0.8878 | −3.7261 | 0.5989 | 1.9569 |
| 0.8819 | −3.7046 | 0.5667 | 2.0760 |
| 0.8758 | −3.6846 | 0.5320 | 2.1887 |
| 0.8696 | −3.6660 | 0.4955 | 2.2941 |
| 0.8630 | −3.6486 | 0.4563 | 2.3951 |
| 0.8562 | −3.6325 | 0.4156 | 2.4894 |
| 0.8491 | −3.6175 | 0.3724 | 2.5798 |
| 0.8415 | −3.6035 | 0.3274 | 2.6652 |
| 0.8337 | −3.5908 | 0.2813 | 2.7450 |
| 0.8254 | −3.5788 | 0.2329 | 2.8213 |
| 0.8165 | −3.5679 | 0.1831 | 2.8933 |
| 0.8072 | −3.5579 | 0.1324 | 2.9604 |
| 0.7971 | −3.5486 | 0.0797 | 3.0245 |
| 0.7863 | −3.5402 | 0.0265 | 3.0841 |
| 0.7744 | −3.5324 | −0.0285 | 3.1410 |
| 0.7613 | −3.5251 | −0.0847 | 3.1945 |
| 0.7470 | −3.5184 | −0.1411 | 3.2440 |
| 0.7306 | −3.5119 | −0.1993 | 3.2911 |
| 0.7120 | −3.5056 | −0.2575 | 3.3344 |
| 0.6895 | −3.4990 | −0.3173 | 3.3752 |
| 0.6616 | −3.4913 | −0.3777 | 3.4126 |
| 0.6247 | −3.4812 | −0.4380 | 3.4456 |
| 0.5658 | −3.4627 | −0.4995 | 3.4719 |

# Tableaux 3

## $\alpha = 0.0000$ et $\gamma = 1.33$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|---|---|---|---|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9940 | .9036 | .9890 | .9496 |
| .9879 | .8174 | .9779 | .9033 |
| .9816 | .7401 | .9668 | .8605 |
| .9752 | .6705 | .9555 | .8210 |
| .9685 | .6072 | .9439 | .7841 |
| .9615 | .5503 | .9323 | .7500 |
| .9544 | .4986 | .9206 | .7184 |
| .9469 | .4514 | .9086 | .6888 |
| .9390 | .4080 | .8962 | .6610 |
| .9308 | .3684 | .8837 | .6352 |
| .9222 | .3320 | .8709 | .6110 |
| .9131 | .2984 | .8576 | .5882 |
| .9033 | .2672 | .8439 | .5668 |
| .8928 | .2381 | .8295 | .5465 |
| .8815 | .2112 | .8146 | .5275 |
| .8692 | .1859 | .7988 | .5096 |
| .8556 | .1622 | .7820 | .4926 |
| .8403 | .1396 | .7637 | .4764 |
| .8229 | .1183 | .7437 | .4612 |
| .8026 | .0978 | .7213 | .4467 |
| .7779 | .0779 | .6952 | .4330 |
| .7461 | .0583 | .6630 | .4199 |
| .7001 | .0382 | .6186 | .4074 |
| .6112 | .0162 | .5369 | .3955 |
| .3538 | .0006 | .3099 | .3898 |

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| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | $-.1650$ |
| .9949 | .9611 | $-.1518$ |
| .9899 | .9255 | $-.1397$ |
| .9848 | .8930 | $-.1285$ |
| .9798 | .8633 | $-.1181$ |
| .9747 | .8360 | $-.1084$ |
| .9696 | .8112 | $-.0994$ |
| .9646 | .7887 | $-.0910$ |
| .9595 | .7682 | $-.0832$ |
| .9544 | .7496 | $-.0758$ |
| .9494 | .7331 | $-.0688$ |
| .9443 | .7184 | $-.0623$ |
| .9393 | .7056 | $-.0561$ |
| .9342 | .6946 | $-.0503$ |
| .9291 | .6857 | $-.0448$ |
| .9241 | .6789 | $-.0395$ |
| .9190 | .6745 | $-.0346$ |
| .9139 | .6729 | $-.0298$ |
| .9089 | .6748 | $-.0252$ |
| .9038 | .6810 | $-.0209$ |
| .8987 | .6935 | $-.0168$ |
| .8937 | .7155 | $-.0128$ |
| .8886 | .7543 | $-.0090$ |
| .8835 | .8311 | $-.0053$ |
| .8785 | 1.0587 | $-.0017$ |
| .8760 | 3.1142 | .0000 |

**Ecoulement d'ordre 2
effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| −41.5661 | −2.8584 | −3.4153 |
| −32.7241 | −2.8254 | −1.7220 |
| −25.6683 | −2.7963 | −.3667 |
| −20.0284 | −2.7713 | .7135 |
| −15.5161 | −2.7503 | 1.5691 |
| −11.8855 | −2.7331 | 2.2443 |
| −9.0022 | −2.7200 | 2.7641 |
| −6.7007 | −2.7108 | 3.1600 |
| −4.8690 | −2.7056 | 3.4538 |
| −3.4099 | −2.7044 | 3.6646 |
| −2.2690 | −2.7071 | 3.8049 |
| −1.3789 | −2.7136 | 3.8885 |
| −.6930 | −2.7241 | 3.9257 |
| −.1737 | −2.7385 | 3.9251 |
| .2115 | −2.7567 | 3.8940 |
| .4828 | −2.7787 | 3.8391 |
| .6631 | −2.8045 | 3.7660 |
| .7685 | −2.8339 | 3.6800 |
| .8123 | −2.8673 | 3.5858 |
| .8044 | −2.9042 | 3.4905 |
| .7534 | −2.9447 | 3.4012 |
| .6648 | −2.9889 | 3.3303 |
| .5419 | −3.0369 | 3.3026 |
| .3822 | −3.0900 | 3.3883 |
| .1725 | −3.1514 | 3.9760 |
| .0063 | −3.1798 | 11.0961 |

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| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −24.2424 | −1.0000 | 5.5039 | −.3300 |
| −17.7248 | −.9915 | 6.2528 | −.5922 |
| −12.6620 | −.9878 | 6.7391 | −.7808 |
| −8.7371 | −.9888 | 7.0203 | −.9113 |
| −5.7054 | −.9944 | 7.1417 | −.9959 |
| −3.3645 | −1.0045 | 7.1386 | −1.0446 |
| −1.5939 | −1.0188 | 7.0394 | −1.0645 |
| −.2615 | −1.0372 | 6.8667 | −1.0620 |
| .7243 | −1.0595 | 6.6383 | −1.0419 |
| 1.4391 | −1.0855 | 6.3665 | −1.0081 |
| 1.9315 | −1.1149 | 6.0661 | −.9638 |
| 2.2521 | −1.1473 | 5.7443 | −.9115 |
| 2.4369 | −1.1826 | 5.4085 | −.8531 |
| 2.5145 | −1.2202 | 5.0643 | −.7903 |
| 2.5076 | −1.2601 | 4.7142 | −.7238 |
| 2.4344 | −1.3011 | 4.3659 | −.6555 |
| 2.3095 | −1.3429 | 4.0203 | −.5859 |
| 2.1443 | −1.3846 | 3.6796 | −.5155 |
| 1.9460 | −1.4252 | 3.3435 | −.4444 |
| 1.7237 | −1.4628 | 3.0175 | −.3740 |
| 1.4807 | −1.4953 | 2.7004 | −.3041 |
| 1.2192 | −1.5189 | 2.3931 | −.2349 |
| .9385 | −1.5267 | 2.0960 | −.1666 |
| .6305 | −1.5018 | 1.8079 | −.0990 |
| .2730 | −1.3767 | 1.5322 | −.0329 |
| .0098 | −.8150 | 1.3894 | −.0004 |

# Tableaux 4

## $\alpha = 0.0000$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9929 | .9064 | .9872 | .9476 |
| .9857 | .8224 | .9742 | .8994 |
| .9783 | .7470 | .9612 | .8550 |
| .9708 | .6788 | .9481 | .8140 |
| .9629 | .6168 | .9348 | .7759 |
| .9548 | .5608 | .9214 | .7408 |
| .9465 | .5098 | .9079 | .7081 |
| .9378 | .4631 | .8941 | .6777 |
| .9288 | .4200 | .8800 | .6491 |
| .9193 | .3807 | .8657 | .6226 |
| .9094 | .3444 | .8511 | .5978 |
| .8989 | .3108 | .8361 | .5745 |
| .8878 | .2795 | .8205 | .5526 |
| .8759 | .2502 | .8044 | .5319 |
| .8630 | .2230 | .7876 | .5125 |
| .8491 | .1974 | .7699 | .4943 |
| .8338 | .1732 | .7511 | .4770 |
| .8166 | .1500 | .7309 | .4606 |
| .7971 | .1280 | .7088 | .4451 |
| .7744 | .1068 | .6841 | .4305 |
| .7471 | .0860 | .6556 | .4165 |
| .7120 | .0652 | .6207 | .4033 |
| .6617 | .0436 | .5729 | .3907 |
| .5659 | .0193 | .4867 | .3787 |
| .3015 | .0008 | .2585 | .3730 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|----------|
| 1.0000 | 1.0000 | −.2000 |
| .9942 | .9611 | −.1839 |
| .9884 | .9256 | −.1691 |
| .9825 | .8933 | −.1555 |
| .9767 | .8638 | −.1428 |
| .9708 | .8369 | −.1310 |
| .9650 | .8125 | −.1201 |
| .9592 | .7904 | −.1100 |
| .9534 | .7705 | −.1005 |
| .9475 | .7525 | −.0915 |
| .9417 | .7366 | −.0831 |
| .9359 | .7228 | −.0752 |
| .9301 | .7109 | −.0678 |
| .9242 | .7011 | −.0608 |
| .9184 | .6934 | −.0541 |
| .9125 | .6881 | −.0477 |
| .9067 | .6855 | −.0417 |
| .9009 | .6861 | −.0360 |
| .8950 | .6907 | −.0305 |
| .8892 | .7005 | −.0253 |
| .8834 | .7177 | −.0203 |
| .8776 | .7464 | −.0155 |
| .8718 | .7956 | −.0109 |
| .8659 | .8923 | −.0064 |
| .8601 | 1.1827 | −.0021 |
| .8572 | 4.1026 | .0000 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-34.0520$ | $-2.8428$ | $-2.3899$ |
| $-26.8885$ | $-2.8121$ | $-.9706$ |
| $-21.1525$ | $-2.7850$ | $.1655$ |
| $-16.5518$ | $-2.7615$ | $1.0713$ |
| $-12.8580$ | $-2.7417$ | $1.7889$ |
| $-9.8754$ | $-2.7254$ | $2.3555$ |
| $-7.4980$ | $-2.7129$ | $2.7921$ |
| $-5.5932$ | $-2.7041$ | $3.1250$ |
| $-4.0712$ | $-2.6990$ | $3.3727$ |
| $-2.8537$ | $-2.6975$ | $3.5513$ |
| $-1.8975$ | $-2.6998$ | $3.6711$ |
| $-1.1478$ | $-2.7058$ | $3.7439$ |
| $-.5670$ | $-2.7154$ | $3.7785$ |
| $-.1246$ | $-2.7287$ | $3.7823$ |
| $.2059$ | $-2.7457$ | $3.7616$ |
| $.4409$ | $-2.7662$ | $3.7222$ |
| $.5988$ | $-2.7903$ | $3.6693$ |
| $.6931$ | $-2.8178$ | $3.6080$ |
| $.7346$ | $-2.8490$ | $3.5431$ |
| $.7311$ | $-2.8833$ | $3.4821$ |
| $.6895$ | $-2.9208$ | $3.4334$ |
| $.6142$ | $-2.9615$ | $3.4123$ |
| $.5070$ | $-3.0050$ | $3.4506$ |
| $.3646$ | $-3.0512$ | $3.6408$ |
| $.1713$ | $-3.0975$ | $4.5014$ |
| $.0072$ | $-3.0210$ | $14.8942$ |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-20.0000$ | $-1.0243$ | $5.3800$ | $-.3968$ |
| $-14.6636$ | $-1.0148$ | $5.9764$ | $-.6555$ |
| $-10.5023$ | $-1.0100$ | $6.3500$ | $-.8402$ |
| $-7.2635$ | $-1.0095$ | $6.5505$ | $-.9665$ |
| $-4.7514$ | $-1.0134$ | $6.6168$ | $-1.0470$ |
| $-2.8030$ | $-1.0215$ | $6.5789$ | $-1.0916$ |
| $-1.3223$ | $-1.0336$ | $6.4614$ | $-1.1075$ |
| $-.2019$ | $-1.0495$ | $6.2837$ | $-1.1013$ |
| $.6321$ | $-1.0691$ | $6.0606$ | $-1.0778$ |
| $1.2415$ | $-1.0922$ | $5.8026$ | $-1.0405$ |
| $1.6656$ | $-1.1183$ | $5.5223$ | $-.9932$ |
| $1.9458$ | $-1.1473$ | $5.2259$ | $-.9380$ |
| $2.1116$ | $-1.1787$ | $4.9194$ | $-.8769$ |
| $2.1866$ | $-1.2122$ | $4.6074$ | $-.8116$ |
| $2.1894$ | $-1.2476$ | $4.2919$ | $-.7428$ |
| $2.1351$ | $-1.2836$ | $3.9797$ | $-.6723$ |
| $2.0357$ | $-1.3200$ | $3.6712$ | $-.6006$ |
| $1.9006$ | $-1.3556$ | $3.3682$ | $-.5282$ |
| $1.7359$ | $-1.3895$ | $3.0703$ | $-.4553$ |
| $1.5487$ | $-1.4194$ | $2.7823$ | $-.3831$ |
| $1.3416$ | $-1.4432$ | $2.5032$ | $-.3115$ |
| $1.1162$ | $-1.4565$ | $2.2333$ | $-.2406$ |
| $.8709$ | $-1.4518$ | $1.9733$ | $-.1706$ |
| $.5969$ | $-1.4104$ | $1.7219$ | $-.1013$ |
| $.2692$ | $-1.2585$ | $1.4822$ | $-.0336$ |
| $.0113$ | $-.6545$ | $1.3546$ | $-.0004$ |

# Tableaux 5

## $\alpha = 0.0000$ et $\gamma = 1.67$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|-------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9890 | .9150 | .9809 | .9403 |
| .9780 | .8382 | .9620 | .8857 |
| .9667 | .7687 | .9430 | .8359 |
| .9554 | .7055 | .9241 | .7901 |
| .9437 | .6475 | .9051 | .7478 |
| .9319 | .5948 | .8861 | .7091 |
| .9198 | .5464 | .8671 | .6733 |
| .9073 | .5018 | .8479 | .6402 |
| .8944 | .4604 | .8285 | .6093 |
| .8811 | .4221 | .8090 | .5808 |
| .8673 | .3865 | .7892 | .5542 |
| .8528 | .3533 | .7691 | .5295 |
| .8377 | .3221 | .7485 | .5063 |
| .8215 | .2925 | .7273 | .4845 |
| .8043 | .2647 | .7056 | .4642 |
| .7859 | .2382 | .6829 | .4451 |
| .7658 | .2128 | .6592 | .4272 |
| .7434 | .1881 | .6339 | .4102 |
| .7185 | .1643 | .6068 | .3943 |
| .6899 | .1407 | .5769 | .3793 |
| .6558 | .1170 | .5430 | .3651 |
| .6129 | .0926 | .5025 | .3517 |
| .5529 | .0660 | .4488 | .3389 |
| .4439 | .0332 | .3566 | .3268 |
| .1834 | .0023 | .1466 | .3210 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | $-.3350$ |
| .9918 | .9612 | $-.3071$ |
| .9836 | .9261 | $-.2817$ |
| .9755 | .8944 | $-.2583$ |
| .9673 | .8657 | $-.2368$ |
| .9591 | .8397 | $-.2168$ |
| .9509 | .8166 | $-.1984$ |
| .9427 | .7960 | $-.1813$ |
| .9345 | .7777 | $-.1654$ |
| .9263 | .7617 | $-.1505$ |
| .9181 | .7481 | $-.1366$ |
| .9100 | .7368 | $-.1236$ |
| .9018 | .7279 | $-.1113$ |
| .8936 | .7216 | $-.0997$ |
| .8854 | .7180 | $-.0887$ |
| .8772 | .7176 | $-.0784$ |
| .8690 | .7208 | $-.0685$ |
| .8608 | .7286 | $-.0592$ |
| .8526 | .7422 | $-.0502$ |
| .8444 | .7638 | $-.0416$ |
| .8363 | .7970 | $-.0334$ |
| .8281 | .8491 | $-.0255$ |
| .8199 | .9363 | $-.0179$ |
| .8117 | 1.1085 | $-.0106$ |
| .8035 | 1.6588 | $-.0035$ |
| .7995 | 9.5474 | .0000 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-19.8974$ | $-2.7870$ | $-.5446$ |
| $-15.8407$ | $-2.7656$ | $.3589$ |
| $-12.5628$ | $-2.7467$ | $1.0831$ |
| $-9.9089$ | $-2.7302$ | $1.6617$ |
| $-7.7572$ | $-2.7164$ | $2.1221$ |
| $-6.0018$ | $-2.7051$ | $2.4880$ |
| $-4.5874$ | $-2.6965$ | $2.7727$ |
| $-3.4411$ | $-2.6907$ | $2.9932$ |
| $-2.5140$ | $-2.6876$ | $3.1613$ |
| $-1.7626$ | $-2.6872$ | $3.2875$ |
| $-1.1639$ | $-2.6896$ | $3.3785$ |
| $-.6872$ | $-2.6949$ | $3.4421$ |
| $-.3114$ | $-2.7028$ | $3.4841$ |
| $-.0193$ | $-2.7135$ | $3.5100$ |
| $.2041$ | $-2.7269$ | $3.5246$ |
| $.3677$ | $-2.7427$ | $3.5323$ |
| $.4822$ | $-2.7609$ | $3.5382$ |
| $.5551$ | $-2.7813$ | $3.5475$ |
| $.5926$ | $-2.8035$ | $3.5673$ |
| $.5986$ | $-2.8268$ | $3.6071$ |
| $.5768$ | $-2.8503$ | $3.6823$ |
| $.5288$ | $-2.8722$ | $3.8216$ |
| $.4538$ | $-2.8886$ | $4.0883$ |
| $.3458$ | $-2.8879$ | $4.6775$ |
| $.1823$ | $-2.8019$ | $6.7453$ |
| $.0097$ | $-.9860$ | $37.4696$ |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-11.9403$ | $-1.0911$ | $5.0155$ | $-.6497$ |
| $-8.8146$ | $-1.0800$ | $5.3157$ | $-.8960$ |
| $-6.3516$ | $-1.0727$ | $5.4701$ | $-1.0657$ |
| $-4.4133$ | $-1.0690$ | $5.5135$ | $-1.1759$ |
| $-2.8921$ | $-1.0687$ | $5.4730$ | $-1.2400$ |
| $-1.6968$ | $-1.0718$ | $5.3684$ | $-1.2683$ |
| $-.7754$ | $-1.0781$ | $5.2176$ | $-1.2686$ |
| $-.0667$ | $-1.0874$ | $5.0325$ | $-1.2476$ |
| $.4709$ | $-1.0994$ | $4.8231$ | $-1.2103$ |
| $.8730$ | $-1.1141$ | $4.5957$ | $-1.1601$ |
| $1.1615$ | $-1.1309$ | $4.3591$ | $-1.1009$ |
| $1.3605$ | $-1.1496$ | $4.1167$ | $-1.0347$ |
| $1.4873$ | $-1.1697$ | $3.8720$ | $-.9634$ |
| $1.5557$ | $-1.1907$ | $3.6279$ | $-.8887$ |
| $1.5766$ | $-1.2122$ | $3.3852$ | $-.8111$ |
| $1.5587$ | $-1.2332$ | $3.1485$ | $-.7325$ |
| $1.5093$ | $-1.2527$ | $2.9177$ | $-.6532$ |
| $1.4338$ | $-1.2697$ | $2.6936$ | $-.5737$ |
| $1.3356$ | $-1.2825$ | $2.4758$ | $-.4939$ |
| $1.2187$ | $-1.2888$ | $2.2673$ | $-.4152$ |
| $1.0841$ | $-1.2852$ | $2.0673$ | $-.3372$ |
| $.9314$ | $-1.2665$ | $1.8760$ | $-.2602$ |
| $.7576$ | $-1.2225$ | $1.6938$ | $-.1843$ |
| $.5518$ | $-1.1287$ | $1.5198$ | $-.1090$ |
| $.2809$ | $-.8890$ | $1.3575$ | $-.0356$ |
| $.0165$ | $-.0386$ | $1.2603$ | $-.0003$ |

# Tableaux 6

## $\alpha = 0.6667$ et $\gamma = 1.33$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|-------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.9605 | 0.7141 | 0.9905 | 0.8743 |
| 0.9362 | 0.5651 | 0.9889 | 0.8193 |
| 0.9200 | 0.4712 | 0.9894 | 0.7901 |
| 0.9085 | 0.4056 | 0.9905 | 0.7728 |
| 0.9002 | 0.3568 | 0.9917 | 0.7618 |
| 0.8938 | 0.3188 | 0.9927 | 0.7545 |
| 0.8889 | 0.2883 | 0.9937 | 0.7493 |
| 0.8850 | 0.2632 | 0.9945 | 0.7456 |
| 0.8805 | 0.2329 | 0.9955 | 0.7417 |
| 0.8762 | 0.2020 | 0.9965 | 0.7384 |
| 0.8719 | 0.1685 | 0.9976 | 0.7356 |
| 0.8674 | 0.1292 | 0.9987 | 0.7333 |
| 0.8633 | 0.0844 | 0.9999 | 0.7318 |
| 0.8593 | 0.0015 | 1.0010 | 0.7310 |

| $u_0$ | $p_0$ | $\psi_0$ |
|-------|-------|----------|
| 1.0000 | 1.0000 | $-0.1650$ |
| 1.0312 | 0.9477 | $-0.0881$ |
| 1.0563 | 0.9348 | $-0.0539$ |
| 1.0755 | 0.9336 | $-0.0357$ |
| 1.0902 | 0.9363 | $-0.0250$ |
| 1.1016 | 0.9402 | $-0.0183$ |
| 1.1106 | 0.9443 | $-0.0138$ |
| 1.1178 | 0.9483 | $-0.0107$ |
| 1.1237 | 0.9519 | $-0.0085$ |
| 1.1306 | 0.9567 | $-0.0062$ |
| 1.1373 | 0.9619 | $-0.0043$ |
| 1.1441 | 0.9677 | $-0.0027$ |
| 1.1514 | 0.9746 | $-0.0013$ |
| 1.1582 | 0.9818 | $-0.0004$ |
| 1.1650 | 0.9901 | 0.0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-0.4830$ | $0.1780$ | $-0.7256$ | $-1.3985$ | $0.0695$ |
| $-0.6324$ | $0.1372$ | $-0.6456$ | $-1.4521$ | $0.0673$ |
| $-0.6297$ | $0.1142$ | $-0.6147$ | $-1.4772$ | $0.0537$ |
| $-0.6060$ | $0.0980$ | $-0.6007$ | $-1.4941$ | $0.0424$ |
| $-0.5793$ | $0.0852$ | $-0.5967$ | $-1.5070$ | $0.0338$ |
| $-0.5519$ | $0.0754$ | $-0.6023$ | $-1.5170$ | $0.0273$ |
| $-0.5257$ | $0.0676$ | $-0.6152$ | $-1.5250$ | $0.0225$ |
| $-0.5017$ | $0.0613$ | $-0.6336$ | $-1.5317$ | $0.0187$ |
| $-0.4799$ | $0.0561$ | $-0.6561$ | $-1.5372$ | $0.0159$ |
| $-0.4510$ | $0.0499$ | $-0.6956$ | $-1.5441$ | $0.0126$ |
| $-0.4185$ | $0.0435$ | $-0.7558$ | $-1.5512$ | $0.0096$ |
| $-0.3798$ | $0.0366$ | $-0.8567$ | $-1.5588$ | $0.0068$ |
| $-0.3294$ | $0.0286$ | $-1.0598$ | $-1.5677$ | $0.0040$ |
| $-0.2644$ | $0.0195$ | $-1.5574$ | $-1.5770$ | $0.0018$ |
| $0.0000$ | $-0.0005$ | $-84.9229$ | $-1.5879$ | $0.0000$ |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| $0.0000$ | $0.0000$ | $0.1991$ | $-0.7256$ | $-1.1703$ |
| $0.1708$ | $-0.3604$ | $0.1372$ | $-0.6201$ | $-1.2312$ |
| $0.2762$ | $-0.4409$ | $0.1070$ | $-0.5755$ | $-1.2314$ |
| $0.3512$ | $-0.4607$ | $0.0883$ | $-0.5527$ | $-1.2233$ |
| $0.4087$ | $-0.4605$ | $0.0749$ | $-0.5421$ | $-1.2152$ |
| $0.4555$ | $-0.4510$ | $0.0652$ | $-0.5422$ | $-1.2083$ |
| $0.4955$ | $-0.4379$ | $0.0578$ | $-0.5499$ | $-1.2025$ |
| $0.5310$ | $-0.4237$ | $0.0520$ | $-0.5632$ | $-1.1979$ |
| $0.5636$ | $-0.4096$ | $0.0474$ | $-0.5807$ | $-1.1942$ |
| $0.6089$ | $-0.3897$ | $0.0419$ | $-0.6125$ | $-1.1899$ |
| $0.6652$ | $-0.3660$ | $0.0364$ | $-0.6622$ | $-1.1859$ |
| $0.7456$ | $-0.3365$ | $0.0306$ | $-0.7469$ | $-1.1819$ |
| $0.8894$ | $-0.2966$ | $0.0239$ | $-0.9193$ | $-1.1781$ |
| $1.2198$ | $-0.2432$ | $0.0164$ | $-1.3445$ | $-1.1748$ |
| $58.2434$ | $0.0000$ | $-0.0005$ | $-72.9706$ | $-1.1724$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-18.3593$ | $-1.3082$ | $-0.2153$ |
| $-7.5175$ | $-1.2985$ | $1.5414$ |
| $-3.3105$ | $-1.3370$ | $2.0367$ |
| $-1.1475$ | $-1.3736$ | $2.2033$ |
| $0.1479$ | $-1.4020$ | $2.2563$ |
| $1.0040$ | $-1.4238$ | $2.2626$ |
| $1.6161$ | $-1.4406$ | $2.2493$ |
| $2.0822$ | $-1.4537$ | $2.2281$ |
| $2.4554$ | $-1.4641$ | $2.2043$ |
| $2.9050$ | $-1.4759$ | $2.1686$ |
| $3.3809$ | $-1.4869$ | $2.1252$ |
| $3.9527$ | $-1.4976$ | $2.0712$ |
| $4.7965$ | $-1.5082$ | $2.0005$ |
| $6.3515$ | $-1.5174$ | $1.9120$ |
| $88.7487$ | $-1.5255$ | $1.7301$ |

| $\rho_{22}^{*}$ | $u_{22}^{*}$ | $p_{22}^{*}$ | $\psi_{22}$ |
|---|---|---|---|
| $-13.6364$ | $-1.1026$ | $2.0156$ | $-0.1893$ |
| $-5.7634$ | $-1.2122$ | $2.1210$ | $-0.3867$ |
| $-2.8006$ | $-1.2513$ | $1.9560$ | $-0.3379$ |
| $-1.3607$ | $-1.2610$ | $1.8043$ | $-0.2697$ |
| $-0.5705$ | $-1.2586$ | $1.6887$ | $-0.2123$ |
| $-0.1087$ | $-1.2522$ | $1.6019$ | $-0.1679$ |
| $0.1737$ | $-1.2448$ | $1.5367$ | $-0.1343$ |
| $0.3515$ | $-1.2374$ | $1.4873$ | $-0.1088$ |
| $0.4651$ | $-1.2306$ | $1.4494$ | $-0.0892$ |
| $0.5631$ | $-1.2218$ | $1.4076$ | $-0.0677$ |
| $0.6194$ | $-1.2122$ | $1.3703$ | $-0.0485$ |
| $0.6312$ | $-1.2018$ | $1.3366$ | $-0.0313$ |
| $0.5818$ | $-1.1900$ | $1.3068$ | $-0.0162$ |
| $0.4465$ | $-1.1783$ | $1.2855$ | $-0.0055$ |
| $0.0000$ | $-1.1661$ | $1.2747$ | $0.0000$ |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| $-.8927$ | .1044 | .2139 |
| $-.5751$ | .1215 | .3706 |
| $-.4075$ | .1301 | .4470 |
| $-.3191$ | .1350 | .4907 |
| $-.2707$ | .1379 | .5187 |
| $-.2436$ | .1397 | .5381 |
| $-.2292$ | .1408 | .5523 |
| $-.2228$ | .1415 | .5632 |
| $-.2217$ | .1419 | .5718 |
| $-.2263$ | .1421 | .5817 |
| $-.2393$ | .1420 | .5913 |
| $-.2660$ | .1414 | .6013 |
| $-.3215$ | .1398 | .6121 |
| $-.4442$ | .1364 | .6235 |
| $-6.4571$ | .1101 | .6381 |

| $\rho_{23}^{*}$ | $u_{23}^{*}$ | $p_{23}^{*}$ |
|---|---|---|
| .0000 | .1719 | .5168 |
| $-.1086$ | .1496 | .4852 |
| $-.0675$ | .1391 | .4831 |
| $-.0311$ | .1331 | .4825 |
| $-.0066$ | .1293 | .4818 |
| .0103 | .1266 | .4811 |
| .0219 | .1245 | .4804 |
| .0296 | .1229 | .4798 |
| .0347 | .1215 | .4793 |
| .0388 | .1199 | .4786 |
| .0404 | .1181 | .4778 |
| .0386 | .1159 | .4770 |
| .0309 | .1129 | .4760 |
| .0133 | .1085 | .4749 |
| .0000 | .0841 | .4713 |

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**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.9465$ | .0791 | .2361 | .1391 |
| $-.5245$ | .1551 | .1770 | .4116 |
| $-.3881$ | .1997 | .1402 | .5366 |
| $-.3493$ | .2285 | .1131 | .6091 |
| $-.3503$ | .2482 | .0901 | .6573 |
| $-.3693$ | .2623 | .0686 | .6920 |
| $-.3971$ | .2726 | .0471 | .7185 |
| $-.4293$ | .2804 | .0250 | .7396 |
| $-.4638$ | .2864 | .0017 | .7569 |
| $-.5170$ | .2929 | $-.0357$ | .7777 |
| $-.5882$ | .2988 | $-.0913$ | .7989 |
| $-.6915$ | .3039 | $-.1880$ | .8218 |
| $-.8671$ | .3077 | $-.4104$ | .8487 |
| $-1.2098$ | .3075 | $-1.1409$ | .8791 |
| $-12.3123$ | .1941 | $-\infty$ | .9314 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1489 | .1481 | .4674 |
| .0320 | .1837 | .0755 | .5590 |
| .0610 | .2043 | .0496 | .5982 |
| .0627 | .2176 | .0393 | .6179 |
| .0510 | .2266 | .0352 | .6294 |
| .0343 | .2329 | .0338 | .6370 |
| .0156 | .2375 | .0336 | .6424 |
| $-.0037$ | .2409 | .0340 | .6466 |
| $-.0230$ | .2434 | .0349 | .6500 |
| $-.0511$ | .2460 | .0367 | .6540 |
| $-.0865$ | .2482 | .0396 | .6581 |
| $-.1351$ | .2497 | .0445 | .6627 |
| $-.2118$ | .2501 | .0540 | .6683 |
| $-.3466$ | .2472 | .0766 | .6750 |
| .0000 | .1467 | $-1.2530$ | .6881 |

# Tableaux 7

## $\alpha = 0.6667$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|---|---|---|---|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9579 | .7485 | .9906 | .8831 |
| .9309 | .6080 | .9891 | .8279 |
| .9122 | .5158 | .9899 | .7971 |
| .8988 | .4495 | .9915 | .7782 |
| .8888 | .3992 | .9931 | .7658 |
| .8811 | .3594 | .9946 | .7572 |
| .8750 | .3270 | .9959 | .7512 |
| .8702 | .3001 | .9971 | .7468 |
| .8646 | .2673 | .9985 | .7356 |
| .8504 | .1689 | 1.0026 | .7328 |
| .8456 | .1255 | 1.0042 | .7307 |
| .8410 | .0675 | 1.0057 | .7293 |
| .8387 | .0018 | 1.0065 | .7290 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0341 | .9623 | $-.1139$ |
| 1.0625 | .9554 | $-.0724$ |
| 1.0852 | .9578 | $-.0493$ |
| 1.1031 | .9633 | $-.0352$ |
| 1.1174 | .9694 | $-.0261$ |
| 1.1288 | .9755 | $-.0199$ |
| 1.1381 | .9811 | $-.0123$ |
| 1.1704 | 1.0054 | $-.0045$ |
| 1.1790 | 1.0134 | $-.0026$ |
| 1.1875 | 1.0219 | $-.0011$ |
| 1.1959 | 1.0312 | $-.0002$ |
| 1.2000 | 1.0364 | .0000 |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| −.4371 | .2128 | −.7522 | −1.3848 | .0828 |
| −.5966 | .1695 | −.6915 | −1.4650 | .0824 |
| −.6175 | .1424 | −.6666 | −1.5095 | .0680 |
| −.6080 | .1228 | −.6570 | −1.5396 | .0549 |
| −.5896 | .1074 | −.6570 | −1.5618 | .0444 |
| −.5678 | .0952 | −.6656 | −1.5788 | .0364 |
| −.5457 | .0854 | −.6809 | −1.5922 | .0301 |
| −.5245 | .0774 | −.7011 | −1.6031 | .0252 |
| −.5046 | .0707 | −.7253 | −1.6122 | .0214 |
| −.4776 | .0625 | −.7673 | −1.6230 | .0171 |
| −.4537 | .0560 | −.8144 | −1.6316 | .0139 |
| −.4200 | .0477 | −.9009 | −1.6424 | .0102 |
| −.3780 | .0386 | −1.0524 | −1.6538 | .0067 |
| −.3244 | .0285 | −1.3595 | −1.6657 | .0036 |
| −.2415 | .0154 | −2.4504 | −1.6785 | .0010 |
| .0000 | −.0004 | −90.4973 | −1.6856 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .2346 | −.7522 | −1.1663 |
| .1580 | −.3337 | .1681 | −.6624 | −1.2332 |
| .2624 | −.4295 | .1324 | −.6206 | −1.2405 |
| .3397 | −.4610 | .1095 | −.5993 | −1.2361 |
| .4008 | −.4683 | .0931 | −.5905 | −1.2297 |
| .4518 | −.4642 | .0810 | −.5916 | −1.2234 |
| .4959 | −.4550 | .0717 | −.5999 | −1.2180 |
| .5355 | −.4437 | .0643 | −.6135 | −1.2134 |
| .5719 | −.4316 | .0583 | −.6312 | −1.2096 |
| .6225 | −.4137 | .0512 | −.6634 | −1.2051 |
| .6699 | −.3968 | .0457 | −.7007 | −1.2016 |
| .7450 | −.3718 | .0388 | −.7706 | −1.1975 |
| .8605 | −.3391 | .0313 | −.8950 | −1.1936 |
| 1.0740 | −.2958 | .0232 | −1.1496 | −1.1900 |
| 1.8014 | −.2263 | .0126 | −2.0608 | −1.1869 |
| 62.1183 | .0000 | −.0003 | −75.9024 | −1.1858 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-15.0567$ | $-1.2983$ | .0592 |
| $-6.8794$ | $-1.2968$ | 1.4474 |
| $-3.3736$ | $-1.3352$ | 1.9104 |
| $-1.4741$ | $-1.3735$ | 2.0956 |
| $-.2979$ | $-1.4050$ | 2.1731 |
| .4986 | $-1.4302$ | 2.2015 |
| 1.0778 | $-1.4502$ | 2.2064 |
| 1.5239 | $-1.4662$ | 2.1996 |
| 1.8841 | $-1.4790$ | 2.1872 |
| 2.3214 | $-1.4939$ | 2.1644 |
| 2.6807 | $-1.5050$ | 2.1404 |
| 3.1799 | $-1.5181$ | 2.1030 |
| 3.8449 | $-1.5309$ | 2.0534 |
| 4.9103 | $-1.5426$ | 1.9887 |
| 7.9767 | $-1.5533$ | 1.8908 |
| 142.2523 | $-1.5581$ | 1.7661 |

| $\rho_{22}^{*}$ | $u_{22}^{*}$ | $p_{22}^{*}$ | $\psi_{22}$ |
|---|---|---|---|
| $-11.2500$ | $-1.1080$ | 1.9626 | $-.2284$ |
| $-5.2637$ | $-1.2071$ | 2.0113 | $-.4079$ |
| $-2.7611$ | $-1.2437$ | 1.8753 | $-.3668$ |
| $-1.4689$ | $-1.2531$ | 1.7455 | $-.3003$ |
| $-.7260$ | $-1.2507$ | 1.6426 | $-.2410$ |
| $-.2724$ | $-1.2438$ | 1.5629 | $-.1934$ |
| .0168 | $-1.2355$ | 1.5015 | $-.1564$ |
| .2066 | $-1.2272$ | 1.4541 | $-.1276$ |
| .3334 | $-1.2194$ | 1.4170 | $-.1052$ |
| .4502 | $-1.2090$ | 1.3755 | $-.0803$ |
| .5140 | $-1.2002$ | 1.3458 | $-.0625$ |
| .5576 | $-1.1888$ | 1.3127 | $-.0428$ |
| .5561 | $-1.1763$ | 1.2832 | $-.0254$ |
| .4925 | $-1.1634$ | 1.2597 | $-.0115$ |
| .3136 | $-1.1502$ | 1.2435 | $-.0021$ |
| .0000 | $-1.1434$ | 1.2398 | .0000 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| $-.7751$ | .1078 | .2534 |
| $-.5289$ | .1258 | .3973 |
| $-.3838$ | .1355 | .4745 |
| $-.3003$ | .1413 | .5525 |
| $-.2212$ | .1473 | .5746 |
| $-.2039$ | .1489 | .5909 |
| $-.1949$ | .1498 | .6035 |
| $-.1914$ | .1505 | .6250 |
| $-.2006$ | .1510 | .6338 |
| $-.2196$ | .1506 | .6444 |
| $-.2586$ | .1495 | .6554 |
| $-.3394$ | .1471 | .6667 |
| $-.5959$ | .1408 | .6794 |
| $-10.7970$ | .1176 | .6885 |

| $\rho_{23}^{*}$ | $u_{23}^{*}$ | $p_{23}^{*}$ |
|---|---|---|
| .0000 | .1794 | .5310 |
| $-.1004$ | .1574 | .5023 |
| $-.0715$ | .1463 | .4992 |
| $-.0383$ | .1396 | .4984 |
| $-.0130$ | .1353 | .4976 |
| .0058 | .1322 | .4968 |
| .0194 | .1298 | .4961 |
| .0290 | .1279 | .4953 |
| .0357 | .1263 | .4946 |
| .0419 | .1244 | .4937 |
| .0450 | .1227 | .4929 |
| .0461 | .1205 | .4918 |
| .0429 | .1177 | .4906 |
| .0324 | .1139 | .4893 |
| .0036 | .1069 | .4875 |
| .0000 | .0863 | .4845 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.7903$ | .0712 | .2204 | .1699 |
| $-.4511$ | .1485 | .1726 | .4214 |
| $-.3269$ | .1973 | .1420 | .5496 |
| $-.2859$ | .2305 | .1190 | .6278 |
| $-.2821$ | .2542 | .0990 | .6810 |
| $-.2965$ | .2716 | .0800 | .7199 |
| $-.3206$ | .2847 | .0609 | .7499 |
| $-.3500$ | .2948 | .0410 | .7739 |
| $-.3826$ | .3026 | .0199 | .7935 |
| $-.4344$ | .3115 | $-.0144$ | .8172 |
| $-.4878$ | .3179 | $-.0522$ | .8360 |
| $-.5772$ | .3249 | $-.1243$ | .8600 |
| $-.7170$ | .3309 | $-.2644$ | .8866 |
| $-.9631$ | .3343 | $-.6136$ | .9162 |
| $-1.6685$ | .3289 | $-2.6066$ | .9541 |
| $-21.8059$ | .2250 | $-\infty$ | .9915 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1436 | .1425 | .4551 |
| .0383 | .1805 | .0827 | .5502 |
| .0706 | .2037 | .0593 | .5949 |
| .0790 | .2192 | .0488 | .6185 |
| .0740 | .2301 | .0439 | .6326 |
| .0626 | .2379 | .0413 | .6418 |
| .0480 | .2437 | .0401 | .6484 |
| .0318 | .2480 | .0396 | .6533 |
| .0150 | .2513 | .0395 | .6572 |
| $-.0106$ | .2549 | .0400 | .6654 |
| $-.0762$ | .2597 | .0426 | .6699 |
| $-.1356$ | .2613 | .0460 | .6750 |
| $-.2320$ | .2608 | .0533 | .6809 |
| $-.4699$ | .2530 | .0796 | .6891 |
| $-.0858$ | .1637 | $-1.6684$ | .6979 |

# Tableaux 8

## $\alpha = 0.6667$ et $\gamma = 1.67$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|--------|--------|--------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9116  | .7018  | .9925  | .8451  |
| .8657  | .5555  | .9994  | .7903  |
| .8386  | .4629  | 1.0069 | .7642  |
| .8214  | .3976  | 1.0129 | .7500  |
| .8099  | .3484  | 1.0175 | .7417  |
| .8019  | .3100  | 1.0209 | .7366  |
| .7962  | .2791  | 1.0235 | .7333  |
| .7904  | .2426  | 1.0263 | .7302  |
| .7839  | .1920  | 1.0295 | .7274  |
| .7777  | .1175  | 1.0328 | .7254  |
| .7748  | .0013  | 1.0343 | .7249  |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | $-.3350$ |
| 1.0887 | 1.0169 | $-.1436$ |
| 1.1544 | 1.0544 | $-.0752$ |
| 1.2006 | 1.0867 | $-.0437$ |
| 1.2332 | 1.1117 | $-.0273$ |
| 1.2564 | 1.1309 | $-.0180$ |
| 1.2731 | 1.1454 | $-.0123$ |
| 1.2855 | 1.1566 | $-.0088$ |
| 1.2985 | 1.1689 | $-.0055$ |
| 1.3134 | 1.1837 | $-.0026$ |
| 1.3280 | 1.1994 | $-.0005$ |
| 1.3350 | 1.2076 | $.0000$ |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-.2970$ | .3345 | $-.8561$ | $-1.3414$ | .1345 |
| $-.5277$ | .2360 | $-.8487$ | $-1.6136$ | .1138 |
| $-.5402$ | .1867 | $-.8991$ | $-1.7550$ | .0794 |
| $-.5308$ | .1512 | $-.9580$ | $-1.8425$ | .0561 |
| $-.5155$ | .1233 | $-1.0247$ | $-1.9011$ | .0404 |
| $-.4961$ | .1024 | $-1.1033$ | $-1.9412$ | .0298 |
| $-.4762$ | .0865 | $-1.1912$ | $-1.9697$ | .0226 |
| $-.4571$ | .0742 | $-1.2859$ | $-1.9905$ | .0175 |
| $-.4311$ | .0603 | $-1.4373$ | $-2.0123$ | .0123 |
| $-.3891$ | .0426 | $-1.7613$ | $-2.0375$ | .0069 |
| $-.3146$ | .0207 | $-2.8009$ | $-2.0629$ | .0020 |
| .0000 | .0000 | $-242.5388$ | $-2.0758$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .3543 | $-.8561$ | $-1.1629$ |
| .2464 | $-.3742$ | .2116 | $-.7737$ | $-1.2755$ |
| .4065 | $-.4346$ | .1542 | $-.7784$ | $-1.2817$ |
| .5325 | $-.4494$ | .1195 | $-.8033$ | $-1.2759$ |
| .6394 | $-.4488$ | .0949 | $-.8417$ | $-1.2699$ |
| .7352 | $-.4395$ | .0777 | $-.8935$ | $-1.2648$ |
| .8244 | $-.4267$ | .0650 | $-.9552$ | $-1.2608$ |
| .9097 | $-.4131$ | .0555 | $-1.0239$ | $-1.2577$ |
| 1.0335 | $-.3935$ | .0450 | $-1.1360$ | $-1.2545$ |
| 1.2742 | $-.3597$ | .0318 | $-1.3807$ | $-1.2508$ |
| 1.9902 | $-.2968$ | .0155 | $-2.1782$ | $-1.2474$ |
| 165.3452 | .0000 | .0000 | $-187.9105$ | $-1.2460$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-8.8280$ | $-1.2584$ | .5445 |
| $-2.9306$ | $-1.3277$ | 1.6803 |
| $-.8739$ | $-1.4222$ | 1.9850 |
| .2000 | $-1.4908$ | 2.1017 |
| .8869 | $-1.5379$ | 2.1487 |
| 1.3938 | $-1.5708$ | 2.1638 |
| 1.8123 | $-1.5942$ | 2.1640 |
| 2.1862 | $-1.6111$ | 2.1573 |
| 2.7101 | $-1.6284$ | 2.1420 |
| 3.7325 | $-1.6477$ | 2.1087 |
| 7.0747 | $-1.6658$ | 2.0383 |
| $+\infty$ | $-1.6738$ | 1.8916 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-6.7164$ | $-1.1173$ | 1.8140 | $-.3795$ |
| $-2.3428$ | $-1.2241$ | 1.6472 | $-.4329$ |
| $-.9145$ | $-1.2284$ | 1.4748 | $-.3000$ |
| $-.2662$ | $-1.2083$ | 1.3644 | $-.2020$ |
| .0633 | $-1.1852$ | 1.2939 | $-.1380$ |
| .2378 | $-1.1653$ | 1.2474 | $-.0965$ |
| .3317 | $-1.1493$ | 1.2162 | $-.0691$ |
| .3812 | $-1.1367$ | 1.1949 | $-.0507$ |
| .4112 | $-1.1227$ | 1.1743 | $-.0331$ |
| .4049 | $-1.1059$ | 1.1537 | $-.0159$ |
| .3070 | $-1.0887$ | 1.1384 | $-.0033$ |
| .0000 | $-1.0801$ | 1.1344 | .0000 |

**Ecoulement d'ordre 2
effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| $-.5254$ | .1250 | .3438 |
| $-.3198$ | .1641 | .5706 |
| $-.2167$ | .1797 | .6760 |
| $-.1723$ | .1874 | .7354 |
| $-.1574$ | .1913 | .7723 |
| $-.1585$ | .1932 | .7967 |
| $-.1693$ | .1938 | .8136 |
| $-.1868$ | .1938 | .8259 |
| $-.2216$ | .1931 | .8388 |
| $-.3099$ | .1910 | .8539 |
| $-.6475$ | .1850 | .8704 |
| $-271.0671$ | .1634 | .8858 |

| $\rho_{23}^{*}$ | $u_{23}^{*}$ | $p_{23}^{*}$ |
|---|---|---|
| .0000 | .2050 | .5821 |
| $-.0687$ | .1741 | .5593 |
| $-.0196$ | .1603 | .5561 |
| .0130 | .1525 | .5528 |
| .0320 | .1475 | .5497 |
| .0438 | .1437 | .5471 |
| .0511 | .1408 | .5451 |
| .0554 | .1384 | .5434 |
| .0581 | .1354 | .5414 |
| .0566 | .1311 | .5389 |
| .0371 | .1238 | .5355 |
| .0000 | .1054 | .5318 |

**Ecoulement d'ordre 2
effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.4714$ | .0502 | .1733 | .2130 |
| $-.2103$ | .1945 | .1361 | .5905 |
| $-.1628$ | .2763 | .1154 | .7706 |
| $-.1873$ | .3282 | .0952 | .8773 |
| $-.2415$ | .3623 | .0689 | .9474 |
| $-.3102$ | .3851 | .0339 | .9967 |
| $-.3872$ | .4007 | $-.0112$ | 1.0331 |
| $-.4698$ | .4114 | $-.0668$ | 1.0610 |
| $-.6010$ | .4218 | $-.1702$ | 1.0921 |
| $-.8811$ | .4313 | $-.4501$ | 1.1319 |
| $-1.8102$ | .4324 | $-1.8747$ | 1.1827 |
| $-\infty$ | .3527 | $-\infty$ | 1.2395 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1265 | .1249 | .4189 |
| .0707 | .2011 | .0790 | .5887 |
| .1060 | .2389 | .0651 | .6498 |
| .1032 | .2611 | .0595 | .6782 |
| .0848 | .2749 | .0561 | .6938 |
| .0608 | .2836 | .0528 | .7034 |
| .0346 | .2891 | .0492 | .7101 |
| .0075 | .2927 | .0455 | .7149 |
| $-.0335$ | .2956 | .0396 | .7202 |
| $-.1138$ | .2971 | .0272 | .7268 |
| $-.3372$ | .2921 | $-.0111$ | .7353 |
| .0000 | .2272 | $-8.4229$ | .7443 |

# Tableaux 9
## $\alpha = 1.00$ et $\gamma = 1.33$

Ecoulement de base

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|--------|--------|--------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9836 | .9155 | 1.0029 | .9657 |
| .9702 | .8460 | 1.0062 | .9400 |
| .9591 | .7874 | 1.0094 | .9204 |
| .9499 | .7371 | 1.0125 | .9051 |
| .9422 | .6933 | 1.0154 | .8930 |
| .9357 | .6546 | 1.0180 | .8834 |
| .9302 | .6202 | 1.0203 | .8756 |
| .9256 | .5894 | 1.0224 | .8693 |
| .9198 | .5486 | 1.0251 | .8620 |
| .9167 | .5244 | 1.0266 | .8581 |
| .9128 | .4919 | 1.0286 | .8535 |
| .9087 | .4543 | 1.0307 | .8491 |
| .9050 | .4147 | 1.0326 | .8453 |
| .9015 | .3694 | 1.0346 | .8420 |
| .8977 | .3070 | 1.0367 | .8389 |
| .8942 | .2125 | 1.0387 | .8366 |
| .8924 | .0058 | 1.0397 | .8360 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | $-.1650$ |
| 1.0196 | .9981 | $-.1288$ |
| 1.0370 | .9986 | $-.1019$ |
| 1.0524 | 1.0005 | $-.0815$ |
| 1.0659 | 1.0031 | $-.0659$ |
| 1.0777 | 1.0060 | $-.0537$ |
| 1.0880 | 1.0090 | $-.0441$ |
| 1.0969 | 1.0120 | $-.0365$ |
| 1.1047 | 1.0148 | $-.0305$ |
| 1.1144 | 1.0187 | $-.0235$ |
| 1.1199 | 1.0212 | $-.0199$ |
| 1.1268 | 1.0244 | $-.0156$ |
| 1.1342 | 1.0282 | $-.0116$ |
| 1.1410 | 1.0320 | $-.0081$ |
| 1.1477 | 1.0361 | $-.0052$ |
| 1.1548 | 1.0410 | $-.0025$ |
| 1.1616 | 1.0463 | $-.0006$ |
| 1.1650 | 1.0496 | .0000 |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-.0366$ | $.1100$ | $-.6964$ | $-1.2045$ | $.0831$ |
| $-.1425$ | $.0919$ | $-.6577$ | $-1.2615$ | $.0744$ |
| $-.2141$ | $.0777$ | $-.6246$ | $-1.3040$ | $.0654$ |
| $-.2638$ | $.0663$ | $-.5962$ | $-1.3366$ | $.0569$ |
| $-.2989$ | $.0571$ | $-.5720$ | $-1.3623$ | $.0493$ |
| $-.3239$ | $.0495$ | $-.5516$ | $-1.3827$ | $.0427$ |
| $-.3417$ | $.0432$ | $-.5346$ | $-1.3993$ | $.0369$ |
| $-.3543$ | $.0379$ | $-.5205$ | $-1.4129$ | $.0320$ |
| $-.3630$ | $.0335$ | $-.5091$ | $-1.4241$ | $.0278$ |
| $-.3708$ | $.0281$ | $-.4963$ | $-1.4376$ | $.0227$ |
| $-.3735$ | $.0252$ | $-.4903$ | $-1.4449$ | $.0199$ |
| $-.3749$ | $.0215$ | $-.4846$ | $-1.4539$ | $.0164$ |
| $-.3733$ | $.0176$ | $-.4820$ | $-1.4632$ | $.0128$ |
| $-.3680$ | $.0141$ | $-.4853$ | $-1.4716$ | $.0096$ |
| $-.3574$ | $.0106$ | $-.4988$ | $-1.4797$ | $.0066$ |
| $-.3347$ | $.0067$ | $-.5421$ | $-1.4885$ | $.0036$ |
| $-.2823$ | $.0028$ | $-.7058$ | $-1.4968$ | $.0010$ |
| $.0000$ | $.0000$ | $-24.4814$ | $-1.5015$ | $.0000$ |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| $.0000$ | $.0000$ | $.1090$ | $-.6964$ | $-1.1889$ |
| $.0705$ | $-.1117$ | $.0891$ | $-.6470$ | $-1.2086$ |
| $.1311$ | $-.1875$ | $.0740$ | $-.6060$ | $-1.2182$ |
| $.1837$ | $-.2404$ | $.0622$ | $-.5718$ | $-1.2222$ |
| $.2298$ | $-.2780$ | $.0529$ | $-.5434$ | $-1.2231$ |
| $.2706$ | $-.3050$ | $.0453$ | $-.5197$ | $-1.2225$ |
| $.3069$ | $-.3244$ | $.0392$ | $-.5002$ | $-1.2210$ |
| $.3395$ | $-.3383$ | $.0342$ | $-.4842$ | $-1.2191$ |
| $.3690$ | $-.3482$ | $.0300$ | $-.4712$ | $-1.2171$ |
| $.4084$ | $-.3574$ | $.0250$ | $-.4565$ | $-1.2141$ |
| $.4320$ | $-.3609$ | $.0223$ | $-.4495$ | $-1.2123$ |
| $.4642$ | $-.3633$ | $.0189$ | $-.4423$ | $-1.2099$ |
| $.5024$ | $-.3628$ | $.0155$ | $-.4380$ | $-1.2072$ |
| $.5446$ | $-.3585$ | $.0123$ | $-.4392$ | $-1.2045$ |
| $.5966$ | $-.3490$ | $.0092$ | $-.4497$ | $-1.2019$ |
| $.6812$ | $-.3279$ | $.0059$ | $-.4866$ | $-1.1992$ |
| $.8784$ | $-.2776$ | $.0025$ | $-.6312$ | $-1.1968$ |
| $25.2011$ | $.0000$ | $.0000$ | $-21.8481$ | $-1.1958$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-13.0390$ | $-.9906$ | .2676 |
| $-10.3274$ | $-.9936$ | .7010 |
| $-8.2530$ | $-1.0035$ | .9992 |
| $-6.6079$ | $-1.0164$ | 1.2100 |
| $-5.2647$ | $-1.0300$ | 1.3613 |
| $-4.1409$ | $-1.0433$ | 1.4706 |
| $-3.1806$ | $-1.0557$ | 1.5495 |
| $-2.3439$ | $-1.0670$ | 1.6062 |
| $-1.6022$ | $-1.0771$ | 1.6464 |
| $-.6220$ | $-1.0902$ | 1.6847 |
| $-.0346$ | $-1.0976$ | 1.6997 |
| .7753 | $-1.1071$ | 1.7113 |
| 1.7633 | $-1.1171$ | 1.7136 |
| 2.9113 | $-1.1264$ | 1.7044 |
| 4.4504 | $-1.1352$ | 1.6816 |
| 7.3440 | $-1.1445$ | 1.6332 |
| 16.3382 | $-1.1527$ | 1.5355 |
| $+\infty$ | $-1.1564$ | 1.2830 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-10.7744$ | $-1.0523$ | 1.2305 | $-.1437$ |
| $-8.7448$ | $-1.0430$ | 1.2893 | $-.2142$ |
| $-7.2013$ | $-1.0283$ | 1.3096 | $-.2392$ |
| $-5.9948$ | $-1.0112$ | 1.3085 | $-.2404$ |
| $-5.0313$ | $-.9933$ | 1.2958 | $-.2294$ |
| $-4.2493$ | $-.9757$ | 1.2770 | $-.2126$ |
| $-3.6061$ | $-.9589$ | 1.2557 | $-.1936$ |
| $-3.0712$ | $-.9432$ | 1.2338 | $-.1745$ |
| $-2.6222$ | $-.9289$ | 1.2125 | $-.1562$ |
| $-2.0743$ | $-.9097$ | 1.1830 | $-.1314$ |
| $-1.7751$ | $-.8985$ | 1.1654 | $-.1169$ |
| $-1.4031$ | $-.8839$ | 1.1422 | $-.0980$ |
| $-1.0172$ | $-.8679$ | 1.1167 | $-.0776$ |
| $-.6617$ | $-.8524$ | 1.0924 | $-.0585$ |
| $-.3219$ | $-.8368$ | 1.0687 | $-.0401$ |
| .0316 | $-.8196$ | 1.0440 | $-.0212$ |
| .3163 | $-.8030$ | 1.0234 | $-.0055$ |
| .0000 | $-.7943$ | 1.0161 | .0000 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| $-.3994$ | .1277 | .2570 |
| $-.4439$ | .1288 | .2709 |
| $-.4646$ | .1299 | .2852 |
| $-.4739$ | .1311 | .2988 |
| $-.4781$ | .1322 | .3113 |
| $-.4807$ | .1332 | .3225 |
| $-.4836$ | .1342 | .3324 |
| $-.4878$ | .1350 | .3413 |
| $-.4940$ | .1357 | .3491 |
| $-.5074$ | .1366 | .3592 |
| $-.5194$ | .1371 | .3650 |
| $-.5419$ | .1378 | .3727 |
| $-.5801$ | .1384 | .3811 |
| $-.6404$ | .1390 | .3896 |
| $-.7466$ | .1394 | .3988 |
| $-1.0033$ | .1399 | .4106 |
| $-1.9880$ | .1400 | .4269 |
| $-\infty$ | .1394 | .4589 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .1220 | .4206 |
| $-.0737$ | .1155 | .4005 |
| $-.1101$ | .1110 | .3894 |
| $-.1261$ | .1078 | .3830 |
| $-.1307$ | .1055 | .3791 |
| $-.1289$ | .1038 | .3766 |
| $-.1233$ | .1025 | .3750 |
| $-.1159$ | .1015 | .3738 |
| $-.1075$ | .1008 | .3730 |
| $-.0944$ | .1000 | .3720 |
| $-.0858$ | .0995 | .3715 |
| $-.0735$ | .0990 | .3709 |
| $-.0587$ | .0985 | .3703 |
| $-.0429$ | .0981 | .3696 |
| $-.0251$ | .0977 | .3689 |
| $-.0024$ | .0972 | .3680 |
| .0251 | .0966 | .3670 |
| .0000 | .0958 | .3662 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.3997$ | .1236 | .1524 | .2486 |
| $-.3572$ | .1469 | .1384 | .3187 |
| $-.3361$ | .1655 | .1275 | .3699 |
| $-.3307$ | .1805 | .1189 | .4086 |
| $-.3372$ | .1929 | .1120 | .4386 |
| $-.3530$ | .2031 | .1064 | .4626 |
| $-.3762$ | .2117 | .1018 | .4822 |
| $-.4057$ | .2189 | .0980 | .4986 |
| $-.4407$ | .2250 | .0948 | .5125 |
| $-.5019$ | .2324 | .0907 | .5299 |
| $-.5479$ | .2365 | .0884 | .5398 |
| $-.6241$ | .2415 | .0853 | .5526 |
| $-.7377$ | .2468 | .0816 | .5669 |
| $-.8977$ | .2515 | .0773 | .5814 |
| $-1.1525$ | .2561 | .0712 | .5975 |
| $-1.7150$ | .2608 | .0580 | .6190 |
| $-3.7030$ | .2650 | .0023 | .6502 |
| $-\infty$ | .2662 | $+\infty$ | .7128 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1179 | .1418 | .4124 |
| .0485 | .1318 | .1158 | .4605 |
| .0834 | .1420 | .0973 | .4919 |
| .1085 | .1497 | .0836 | .5130 |
| .1265 | .1556 | .0732 | .5276 |
| .1392 | .1602 | .0652 | .5377 |
| .1481 | .1639 | .0588 | .5450 |
| .1542 | .1668 | .0536 | .5503 |
| .1582 | .1692 | .0494 | .5541 |
| .1615 | .1720 | .0442 | .5582 |
| .1623 | .1735 | .0414 | .5601 |
| .1621 | .1753 | .0378 | .5622 |
| .1601 | .1771 | .0339 | .5640 |
| .1559 | .1787 | .0300 | .5654 |
| .1486 | .1802 | .0256 | .5665 |
| .1338 | .1817 | .0192 | .5675 |
| .0981 | .1830 | .0063 | .5683 |
| .0000 | .1828 | $-.4692$ | .5690 |

# Tableaux 10

## $\alpha = 1.00$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9848 | .9366 | 1.0030 | .9732 |
| .9717 | .8821 | 1.0063 | .9518 |
| .9604 | .8343 | 1.0096 | .9345 |
| .9507 | .7919 | 1.0128 | .9202 |
| .9422 | .7540 | 1.0159 | .9084 |
| .9348 | .7197 | 1.0189 | .8985 |
| .9284 | .6885 | 1.0216 | .8902 |
| .9228 | .6600 | 1.0241 | .8832 |
| .9178 | .6338 | 1.0264 | .8773 |
| .9135 | .6097 | 1.0285 | .8722 |
| .9097 | .5873 | 1.0304 | .8678 |
| .9048 | .5566 | 1.0329 | .8625 |
| .9007 | .5289 | 1.0351 | .8582 |
| .8963 | .4960 | 1.0375 | .8537 |
| .8913 | .4534 | 1.0403 | .8490 |
| .8871 | .4120 | 1.0427 | .8454 |
| .8830 | .3600 | 1.0452 | .8421 |
| .8791 | .2897 | 1.0476 | .8395 |
| .8751 | .0076 | 1.0501 | .8377 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0185 | 1.0035 | $-.1648$ |
| 1.0356 | 1.0081 | $-.1369$ |
| 1.0512 | 1.0131 | $-.1145$ |
| 1.0654 | 1.0182 | $-.0963$ |
| 1.0783 | 1.0233 | $-.0815$ |
| 1.0899 | 1.0282 | $-.0693$ |
| 1.1004 | 1.0328 | $-.0591$ |
| 1.1098 | 1.0372 | $-.0507$ |
| 1.1183 | 1.0413 | $-.0436$ |
| 1.1259 | 1.0452 | $-.0377$ |
| 1.1327 | 1.0487 | $-.0327$ |
| 1.1416 | 1.0535 | $-.0266$ |
| 1.1492 | 1.0578 | $-.0218$ |
| 1.1576 | 1.0628 | $-.0169$ |
| 1.1673 | 1.0688 | $-.0118$ |
| 1.1754 | 1.0742 | $-.0080$ |
| 1.1837 | 1.0801 | $-.0046$ |
| 1.1917 | 1.0864 | $-.0019$ |
| 1.2000 | 1.0939 | $.0000$ |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| −.0322 | .1332 | −.7216 | −1.2091 | .1011 |
| −.1165 | .1162 | −.6955 | −1.2643 | .0930 |
| −.1790 | .1020 | −.6723 | −1.3090 | .0843 |
| −.2262 | .0901 | −.6517 | −1.3458 | .0758 |
| −.2624 | .0799 | −.6334 | −1.3764 | .0679 |
| −.2904 | .0712 | −.6173 | −1.4021 | .0607 |
| −.3122 | .0637 | −.6033 | −1.4239 | .0541 |
| −.3291 | .0572 | −.5912 | −1.4425 | .0482 |
| −.3423 | .0515 | −.5809 | −1.4585 | .0430 |
| −.3525 | .0465 | −.5722 | −1.4723 | .0384 |
| −.3603 | .0422 | −.5650 | −1.4842 | .0343 |
| −.3663 | .0383 | −.5592 | −1.4946 | .0307 |
| −.3723 | .0334 | −.5530 | −1.5079 | .0261 |
| −.3758 | .0293 | −.5494 | −1.5188 | .0222 |
| −.3775 | .0248 | −.5482 | −1.5305 | .0181 |
| −.3758 | .0196 | −.5527 | −1.5437 | .0135 |
| −.3572 | .0107 | −.5975 | −1.5654 | .0061 |
| −.3298 | .0061 | −.6826 | −1.5760 | .0028 |
| .0000 | .0000 | −23.5618 | −1.5873 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1319 | $-.7216$ | $-1.1949$ |
| .0562 | $-.0882$ | .1129 | $-.6849$ | $-1.2146$ |
| .1066 | $-.1538$ | .0975 | $-.6533$ | $-1.2265$ |
| .1520 | $-.2036$ | .0848 | $-.6259$ | $-1.2334$ |
| .1933 | $-.2418$ | .0743 | $-.6022$ | $-1.2373$ |
| .2311 | $-.2714$ | .0655 | $-.5817$ | $-1.2391$ |
| .2657 | $-.2946$ | .0580 | $-.5640$ | $-1.2395$ |
| .2977 | $-.3127$ | .0516 | $-.5489$ | $-1.2392$ |
| .3272 | $-.3270$ | .0462 | $-.5360$ | $-1.2383$ |
| .3547 | $-.3381$ | .0414 | $-.5251$ | $-1.2372$ |
| .3804 | $-.3467$ | .0374 | $-.5161$ | $-1.2358$ |
| .4044 | $-.3533$ | .0338 | $-.5087$ | $-1.2345$ |
| .4378 | $-.3603$ | .0293 | $-.5004$ | $-1.2324$ |
| .4685 | $-.3646$ | .0255 | $-.4949$ | $-1.2305$ |
| .5061 | $-.3671$ | .0215 | $-.4913$ | $-1.2281$ |
| .5567 | $-.3665$ | .0169 | $-.4926$ | $-1.2253$ |
| .6095 | $-.3618$ | .0131 | $-.5017$ | $-1.2228$ |
| .6839 | $-.3501$ | .0092 | $-.5276$ | $-1.2202$ |
| .8113 | $-.3242$ | .0052 | $-.6001$ | $-1.2177$ |
| 24.2747 | .0000 | .0000 | $-20.6180$ | $-1.2155$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-10.7057$ | $-.9784$ | .4001 |
| $-8.9785$ | $-.9838$ | .6877 |
| $-7.5718$ | $-.9934$ | .9060 |
| $-6.3994$ | $-1.0050$ | 1.0748 |
| $-5.4038$ | $-1.0176$ | 1.2072 |
| $-4.5447$ | $-1.0302$ | 1.3116 |
| $-3.7931$ | $-1.0424$ | 1.3944 |
| $-3.1270$ | $-1.0541$ | 1.4601 |
| $-2.5299$ | $-1.0649$ | 1.5121 |
| $-1.9887$ | $-1.0750$ | 1.5531 |
| $-1.4930$ | $-1.0842$ | 1.5853 |
| $-1.0346$ | $-1.0926$ | 1.6102 |
| $-.4025$ | $-1.1037$ | 1.6370 |
| .1785 | $-1.1132$ | 1.6542 |
| .8969 | $-1.1239$ | 1.6663 |
| 1.8995 | $-1.1361$ | 1.6698 |
| 3.0174 | $-1.1463$ | 1.6616 |
| 4.7779 | $-1.1565$ | 1.6379 |
| 8.4801 | $-1.1661$ | 1.5880 |
| $+\infty$ | $-1.1753$ | 1.3043 |

| $\rho^\star_{22}$ | $u^\star_{22}$ | $p^\star_{22}$ | $\psi_{22}$ |
|---|---|---|---|
| $-8.8889$ | $-1.0511$ | $1.1995$ | $-.1744$ |
| $-7.5857$ | $-1.0443$ | $1.2333$ | $-.2268$ |
| $-6.5275$ | $-1.0335$ | $1.2485$ | $-.2501$ |
| $-5.6532$ | $-1.0203$ | $1.2516$ | $-.2558$ |
| $-4.9210$ | $-1.0059$ | $1.2470$ | $-.2509$ |
| $-4.3010$ | $-.9911$ | $1.2373$ | $-.2398$ |
| $-3.7713$ | $-.9764$ | $1.2247$ | $-.2254$ |
| $-3.3153$ | $-.9621$ | $1.2103$ | $-.2095$ |
| $-2.9202$ | $-.9484$ | $1.1953$ | $-.1931$ |
| $-2.5760$ | $-.9355$ | $1.1802$ | $-.1771$ |
| $-2.2746$ | $-.9234$ | $1.1654$ | $-.1618$ |
| $-2.0096$ | $-.9121$ | $1.1512$ | $-.1474$ |
| $-1.6691$ | $-.8969$ | $1.1315$ | $-.1277$ |
| $-1.3847$ | $-.8834$ | $1.1139$ | $-.1105$ |
| $-1.0745$ | $-.8680$ | $1.0935$ | $-.0911$ |
| $-.7205$ | $-.8496$ | $1.0692$ | $-.0685$ |
| $-.4263$ | $-.8337$ | $1.0485$ | $-.0496$ |
| $-.1281$ | $-.8169$ | $1.0275$ | $-.0307$ |
| $.1510$ | $-.8002$ | $1.0081$ | $-.0137$ |
| $.0000$ | $-.7825$ | $.9925$ | $.0000$ |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|:-----------:|:--------:|:--------:|
| $-.3390$ | .1364 | .2916 |
| $-.3780$ | .1372 | .3029 |
| $-.4006$ | .1381 | .3145 |
| $-.4137$ | .1390 | .3257 |
| $-.4211$ | .1399 | .3364 |
| $-.4255$ | .1408 | .3463 |
| $-.4283$ | .1417 | .3555 |
| $-.4307$ | .1425 | .3639 |
| $-.4333$ | .1433 | .3715 |
| $-.4366$ | .1440 | .3785 |
| $-.4409$ | .1446 | .3849 |
| $-.4465$ | .1452 | .3907 |
| $-.4572$ | .1459 | .3984 |
| $-.4712$ | .1465 | .4051 |
| $-.4951$ | .1472 | .4128 |
| $-.5419$ | .1480 | .4222 |
| $-.6128$ | .1485 | .4308 |
| $-.7580$ | .1490 | .4407 |
| $-1.1415$ | .1493 | .4528 |
| $-\infty$ | .1487 | .4931 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .1287 | .4359 |
| −.0590 | .1228 | .4195 |
| −.0942 | .1183 | .4090 |
| −.1143 | .1149 | .4021 |
| −.1247 | .1123 | .3974 |
| −.1289 | .1103 | .3942 |
| −.1288 | .1087 | .3918 |
| −.1261 | .1074 | .3901 |
| −.1216 | .1064 | .3887 |
| −.1161 | .1055 | .3877 |
| −.1098 | .1049 | .3869 |
| −.1033 | .1043 | .3861 |
| −.0933 | .1036 | .3853 |
| −.0835 | .1031 | .3846 |
| −.0710 | .1025 | .3838 |
| −.0543 | .1019 | .3829 |
| −.0379 | .1014 | .3820 |
| −.0178 | .1009 | .3811 |
| .0068 | .1003 | .3800 |
| .0000 | .0990 | .3784 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|:---:|:---:|:---:|:---:|
| $-.3163$ | .1217 | .1477 | .2741 |
| $-.2850$ | .1428 | .1385 | .3332 |
| $-.2659$ | .1605 | .1312 | .3799 |
| $-.2563$ | .1757 | .1253 | .4175 |
| $-.2545$ | .1887 | .1204 | .4483 |
| $-.2590$ | .2000 | .1164 | .4738 |
| $-.2690$ | .2098 | .1131 | .4953 |
| $-.2835$ | .2185 | .1103 | .5135 |
| $-.3021$ | .2260 | .1080 | .5293 |
| $-.3242$ | .2326 | .1060 | .5430 |
| $-.3497$ | .2385 | .1042 | .5550 |
| $-.3781$ | .2436 | .1027 | .5657 |
| $-.4260$ | .2503 | .1006 | .5797 |
| $-.4798$ | .2559 | .0987 | .5916 |
| $-.5601$ | .2619 | .0964 | .6052 |
| $-.6977$ | .2688 | .0930 | .6219 |
| $-.8831$ | .2744 | .0885 | .6372 |
| $-1.2265$ | .2800 | .0800 | .6556 |
| $-2.0560$ | .2854 | .0560 | .6789 |
| $-\infty$ | .2895 | $+\infty$ | .7598 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1150 | .1384 | .4084 |
| .0378 | .1280 | .1198 | .4505 |
| .0675 | .1384 | .1056 | .4809 |
| .0908 | .1466 | .0944 | .5034 |
| .1090 | .1533 | .0855 | .5202 |
| .1232 | .1588 | .0783 | .5329 |
| .1342 | .1634 | .0724 | .5427 |
| .1427 | .1672 | .0674 | .5502 |
| .1491 | .1705 | .0631 | .5561 |
| .1540 | .1732 | .0595 | .5607 |
| .1575 | .1755 | .0563 | .5643 |
| .1600 | .1775 | .0535 | .5673 |
| .1622 | .1800 | .0498 | .5706 |
| .1631 | .1821 | .0467 | .5731 |
| .1626 | .1842 | .0431 | .5755 |
| .1598 | .1866 | .0386 | .5778 |
| .1547 | .1885 | .0341 | .5793 |
| .1448 | .1903 | .0282 | .5807 |
| .1248 | .1920 | .0186 | .5819 |
| .0000 | .1928 | $-.5511$ | .5833 |

# tableaux 11

## $\alpha = 1.00$ et $\gamma = 1.67$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|--------|--------|--------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9855  | .9675  | 1.0039 | .9848  |
| .9724  | .9376  | 1.0080 | .9715  |
| .9604  | .9099  | 1.0121 | .9598  |
| .9494  | .8839  | 1.0162 | .9495  |
| .9394  | .8595  | 1.0202 | .9402  |
| .9302  | .8365  | 1.0242 | .9318  |
| .9217  | .8148  | 1.0280 | .9243  |
| .9139  | .7941  | 1.0318 | .9174  |
| .9067  | .7744  | 1.0353 | .9112  |
| .9002  | .7557  | 1.0388 | .9056  |
| .8941  | .7378  | 1.0420 | .9005  |
| .8858  | .7123  | 1.0467 | .8937  |
| .8786  | .6884  | 1.0509 | .8877  |
| .8721  | .6659  | 1.0548 | .8825  |
| .8646  | .6378  | 1.0595 | .8766  |
| .8598  | .6181  | 1.0627 | .8728  |
| .8529  | .5876  | 1.0673 | .8676  |
| .8472  | .5595  | 1.0712 | .8634  |
| .8410  | .5241  | 1.0757 | .8590  |
| .8351  | .4840  | 1.0800 | .8550  |
| .8295  | .4350  | 1.0842 | .8515  |
| .8239  | .3629  | 1.0885 | .8483  |
| .8186  | .0130  | 1.0928 | .8461  |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | −.3350 |
| 1.0186 | 1.0139 | −.2973 |
| 1.0366 | 1.0275 | −.2646 |
| 1.0538 | 1.0406 | −.2360 |
| 1.0703 | 1.0533 | −.2109 |
| 1.0861 | 1.0654 | −.1888 |
| 1.1011 | 1.0770 | −.1693 |
| 1.1154 | 1.0880 | −.1520 |
| 1.1290 | 1.0984 | −.1367 |
| 1.1418 | 1.1083 | −.1230 |
| 1.1540 | 1.1177 | −.1108 |
| 1.1655 | 1.1265 | −.1000 |
| 1.1815 | 1.1388 | −.0858 |
| 1.1962 | 1.1501 | −.0738 |
| 1.2095 | 1.1603 | −.0635 |
| 1.2254 | 1.1725 | −.0523 |
| 1.2360 | 1.1807 | −.0452 |
| 1.2514 | 1.1927 | −.0357 |
| 1.2643 | 1.2028 | −.0284 |
| 1.2790 | 1.2145 | −.0208 |
| 1.2931 | 1.2259 | −.0141 |
| 1.3070 | 1.2374 | −.0084 |
| 1.3211 | 1.2496 | −.0034 |
| 1.3350 | 1.2627 | .0000 |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| −.0201 | .2219 | −.8187 | −1.2258 | .1720 |
| −.0707 | .2058 | −.8129 | −1.2825 | .1633 |
| −.1135 | .1911 | −.8075 | −1.3338 | .1541 |
| −.1499 | .1778 | −.8026 | −1.3803 | .1448 |
| −.1812 | .1656 | −.7980 | −1.4227 | .1356 |
| −.2082 | .1544 | −.7939 | −1.4615 | .1267 |
| −.2316 | .1440 | −.7902 | −1.4970 | .1181 |
| −.2521 | .1345 | −.7870 | −1.5296 | .1099 |
| −.2699 | .1256 | −.7841 | −1.5596 | .1021 |
| −.2856 | .1174 | −.7818 | −1.5871 | .0948 |
| −.2993 | .1098 | −.7798 | −1.6124 | .0879 |
| −.3114 | .1027 | −.7783 | −1.6357 | .0815 |
| −.3268 | .0931 | −.7770 | −1.6673 | .0727 |
| −.3395 | .0844 | −.7767 | −1.6952 | .0648 |
| −.3610 | .0673 | −.7800 | −1.7484 | .0495 |
| −.3675 | .0613 | −.7831 | −1.7670 | .0441 |
| −.3756 | .0524 | −.7904 | −1.7933 | .0365 |
| −.3809 | .0450 | −.8004 | −1.8149 | .0303 |
| −.3849 | .0366 | −.8183 | −1.8387 | .0234 |
| −.3858 | .0284 | −.8473 | −1.8612 | .0170 |
| −.3820 | .0201 | −.8989 | −1.8827 | .0109 |
| −.3667 | .0112 | −1.0204 | −1.9043 | .0051 |
| .0000 | .0000 | −26.4702 | −1.9257 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .2197 | −.8187 | −1.2161 |
| .0361 | −.0520 | .2004 | −.8012 | −1.2372 |
| .0705 | −.0960 | .1834 | −.7852 | −1.2536 |
| .1033 | −.1335 | .1682 | −.7708 | −1.2664 |
| .1348 | −.1656 | .1547 | −.7577 | −1.2765 |
| .1650 | −.1935 | .1425 | −.7458 | −1.2843 |
| .1941 | −.2176 | .1315 | −.7351 | −1.2903 |
| .2222 | −.2387 | .1216 | −.7253 | −1.2950 |
| .2493 | −.2572 | .1125 | −.7166 | −1.2985 |
| .2756 | −.2734 | .1042 | −.7089 | −1.3011 |
| .3011 | −.2876 | .0967 | −.7020 | −1.3031 |
| .3258 | −.3001 | .0898 | −.6959 | −1.3044 |
| .3617 | −.3162 | .0805 | −.6883 | −1.3056 |
| .3961 | −.3295 | .0723 | −.6823 | −1.3060 |
| .4292 | −.3404 | .0651 | −.6780 | −1.3060 |
| .4715 | −.3521 | .0568 | −.6744 | −1.3053 |
| .5021 | −.3589 | .0513 | −.6733 | −1.3046 |
| .5509 | −.3676 | .0436 | −.6742 | −1.3032 |
| .5975 | −.3734 | .0372 | −.6781 | --1.3017 |
| .6595 | −.3780 | .0300 | −.6882 | −1.2997 |
| .7348 | −.3795 | .0231 | −.7076 | −1.2976 |
| .8369 | −.3765 | .0163 | −.7457 | −1.2952 |
| 1.0196 | −.3622 | .0090 | −.8408 | −1.2927 |
| 27.0753 | .0000 | .0000 | −21.6675 | −1.2903 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-6.2903$ | $-.9343$ | .6356 |
| $-5.7114$ | $-.9456$ | .7452 |
| $-5.1946$ | $-.9579$ | .8412 |
| $-4.7288$ | $-.9708$ | .9262 |
| $-4.3054$ | $-.9839$ | 1.0022 |
| $-3.9180$ | $-.9971$ | 1.0705 |
| $-3.5614$ | $-1.0101$ | 1.1321 |
| $-3.2313$ | $-1.0229$ | 1.1877 |
| $-2.9243$ | $-1.0354$ | 1.2381 |
| $-2.6376$ | $-1.0475$ | 1.2836 |
| $-2.3685$ | $-1.0592$ | 1.3249 |
| $-2.1150$ | $-1.0704$ | 1.3621 |
| $-1.7599$ | $-1.0863$ | 1.4113 |
| $-1.4305$ | $-1.1011$ | 1.4533 |
| $-1.1221$ | $-1.1148$ | 1.4889 |
| $-.7373$ | $-1.1313$ | 1.5279 |
| $-.4643$ | $-1.1424$ | 1.5517 |
| $-.0309$ | $-1.1587$ | 1.5825 |
| .3845 | $-1.1725$ | 1.6044 |
| .9524 | $-1.1882$ | 1.6237 |
| 1.6871 | $-1.2033$ | 1.6351 |
| 2.8165 | $-1.2181$ | 1.6359 |
| 5.4380 | $-1.2330$ | 1.6164 |
| $+\infty$ | $-1.2470$ | 1.3872 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −5.3068 | −1.0447 | 1.1095 | −.2947 |
| −4.8577 | −1.0418 | 1.1125 | −.3124 |
| −4.4567 | −1.0365 | 1.1139 | −.3206 |
| −4.0963 | −1.0294 | 1.1137 | −.3217 |
| −3.7705 | −1.0211 | 1.1123 | −.3178 |
| −3.4746 | −1.0118 | 1.1096 | −.3103 |
| −3.2050 | −1.0019 | 1.1059 | −.3002 |
| −2.9584 | −.9916 | 1.1013 | −.2884 |
| −2.7323 | −.9811 | 1.0960 | −.2755 |
| −2.5245 | −.9705 | 1.0901 | −.2619 |
| −2.3331 | −.9599 | 1.0838 | −.2481 |
| −2.1565 | −.9495 | 1.0772 | −.2342 |
| −1.9163 | −.9342 | 1.0670 | −.2138 |
| −1.7022 | −.9195 | 1.0566 | −.1942 |
| −1.5109 | −.9056 | 1.0463 | −.1758 |
| −1.2866 | −.8884 | 1.0329 | −.1533 |
| −1.1384 | −.8765 | 1.0235 | −.1380 |
| −.9240 | −.8586 | 1.0089 | −.1155 |
| −.7439 | −.8430 | .9960 | −.0965 |
| −.5384 | −.8249 | .9808 | −.0749 |
| −.3365 | −.8068 | .9656 | −.0543 |
| −.1331 | −.7886 | .9506 | −.0345 |
| .0830 | −.7696 | .9355 | −.0154 |
| .0000 | −.7503 | .9231 | .0000 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|:---:|:---:|:---:|
| $-.2171$ | .1688 | .3862 |
| $-.2439$ | .1698 | .3971 |
| $-.2644$ | .1708 | .4077 |
| $-.2801$ | .1717 | .4179 |
| $-.2922$ | .1726 | .4276 |
| $-.3015$ | .1735 | .4370 |
| $-.3087$ | .1744 | .4459 |
| $-.3143$ | .1753 | .4544 |
| $-.3187$ | .1762 | .4625 |
| $-.3222$ | .1771 | .4702 |
| $-.3252$ | .1779 | .4775 |
| $-.3277$ | .1788 | .4844 |
| $-.3313$ | .1799 | .4940 |
| $-.3349$ | .1810 | .5028 |
| $-.3389$ | .1821 | .5109 |
| $-.3454$ | .1833 | .5205 |
| $-.3515$ | .1841 | .5270 |
| $-.3642$ | .1853 | .5365 |
| $-.3809$ | .1863 | .5447 |
| $-.4118$ | .1873 | .5542 |
| $-.4654$ | .1883 | .5638 |
| $-.5734$ | .1891 | .5741 |
| $-.8925$ | .1896 | .5867 |
| $-\infty$ | .1890 | .6288 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .1524 | .4897 |
| −.0344 | .1475 | .4800 |
| −.0604 | .1434 | .4724 |
| −.0799 | .1399 | .4663 |
| −.0945 | .1369 | .4613 |
| −.1052 | .1343 | .4573 |
| −.1129 | .1321 | .4539 |
| −.1180 | .1302 | .4511 |
| −.1213 | .1286 | .4487 |
| −.1229 | .1272 | .4466 |
| −.1233 | .1259 | .4448 |
| −.1227 | .1249 | .4432 |
| −.1203 | .1235 | .4411 |
| −.1166 | .1224 | .4394 |
| −.1119 | .1215 | .4379 |
| −.1049 | .1205 | .4362 |
| −.0992 | .1198 | .4350 |
| −.0893 | .1190 | .4334 |
| −.0794 | .1184 | .4320 |
| −.0660 | .1177 | .4304 |
| −.0502 | .1170 | .4288 |
| −.0306 | .1163 | .4271 |
| −.0025 | .1154 | .4251 |
| .0000 | .1137 | .4223 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.1620$ | .1161 | .1330 | .3195 |
| $-.1466$ | .1346 | .1312 | .3657 |
| $-.1344$ | .1515 | .1300 | .4070 |
| $-.1251$ | .1672 | .1293 | .4440 |
| $-.1185$ | .1817 | .1289 | .4774 |
| $-.1143$ | .1952 | .1289 | .5076 |
| $-.1124$ | .2077 | .1292 | .5349 |
| $-.1125$ | .2194 | .1297 | .5597 |
| $-.1145$ | .2303 | .1304 | .5823 |
| $-.1182$ | .2405 | .1311 | .6029 |
| $-.1237$ | .2501 | .1320 | .6218 |
| $-.1307$ | .2590 | .1330 | .6391 |
| $-.1442$ | .2713 | .1345 | .6623 |
| $-.1608$ | .2824 | .1360 | .6829 |
| $-.1807$ | .2924 | .1375 | .7011 |
| $-.2119$ | .3043 | .1394 | .7223 |
| $-.2388$ | .3122 | .1406 | .7362 |
| $-.2903$ | .3235 | .1422 | .7563 |
| $-.3503$ | .3330 | .1433 | .7733 |
| $-.4488$ | .3437 | .1436 | .7930 |
| $-.6014$ | .3540 | .1418 | .8130 |
| $-.8768$ | .3640 | .1348 | .8346 |
| $-1.6109$ | .3741 | .1062 | .8619 |
| $-\infty$ | .3823 | $+\infty$ | .9532 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1058 | .1275 | .3965 |
| .0211 | .1181 | .1202 | .4304 |
| .0400 | .1289 | .1142 | .4589 |
| .0567 | .1384 | .1091 | .4829 |
| .0715 | .1468 | .1048 | .5032 |
| .0845 | .1542 | .1010 | .5205 |
| .0960 | .1609 | .0978 | .5353 |
| .1061 | .1669 | .0950 | .5481 |
| .1149 | .1723 | .0926 | .5590 |
| .1227 | .1771 | .0903 | .5685 |
| .1294 | .1815 | .0883 | .5767 |
| .1352 | .1855 | .0865 | .5838 |
| .1425 | .1908 | .0840 | .5928 |
| .1483 | .1954 | .0818 | .6002 |
| .1528 | .1995 | .0797 | .6062 |
| .1572 | .2041 | .0770 | .6126 |
| .1595 | .2070 | .0752 | .6164 |
| .1617 | .2112 | .0721 | .6215 |
| .1623 | .2146 | .0692 | .6253 |
| .1613 | .2183 | .0650 | .6290 |
| .1577 | .2217 | .0596 | .6323 |
| .1499 | .2250 | .0516 | .6351 |
| .1310 | .2282 | .0359 | .6377 |
| .0000 | .2300 | $-1.0983$ | .6406 |

# tableaux 12

## $\alpha = 1.2$ et $\gamma = 1.33$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|---------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9966 | .9873 | 1.0014 | .9953 |
| .9917 | .9689 | 1.0034 | .9887 |
| .9870 | .9513 | 1.0053 | .9825 |
| .9827 | .9342 | 1.0073 | .9767 |
| .9772 | .9125 | 1.0098 | .9696 |
| .9733 | .8968 | 1.0116 | .9646 |
| .9685 | .8768 | 1.0139 | .9585 |
| .9651 | .8623 | 1.0156 | .9542 |
| .9609 | .8437 | 1.0178 | .9489 |
| .9560 | .8216 | 1.0204 | .9429 |
| .9525 | .8046 | 1.0223 | .9385 |
| .9484 | .7844 | 1.0246 | .9336 |
| .9446 | .7651 | 1.0268 | .9291 |
| .9406 | .7431 | 1.0291 | .9243 |
| .9370 | .7223 | 1.0313 | .9201 |
| .9332 | .6993 | 1.0336 | .9158 |
| .9295 | .6747 | 1.0359 | .9116 |
| .9263 | .6517 | 1.0380 | .9081 |
| .9226 | .6223 | 1.0404 | .9042 |
| .9191 | .5907 | 1.0427 | .9005 |
| .9156 | .5537 | 1.0451 | .8971 |
| .9123 | .5102 | 1.0474 | .8939 |
| .9090 | .4510 | 1.0497 | .8910 |
| .9057 | .3480 | 1.0521 | .8886 |
| .9041 | .0350 | 1.0532 | .8877 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|----------|
| 1.0000 | 1.0000 | $-.1650$ |
| 1.0048 | 1.0022 | $-.1571$ |
| 1.0118 | 1.0054 | $-.1460$ |
| 1.0185 | 1.0085 | $-.1357$ |
| 1.0251 | 1.0115 | $-.1262$ |
| 1.0334 | 1.0154 | $-.1147$ |
| 1.0393 | 1.0182 | $-.1068$ |
| 1.0469 | 1.0218 | $-.0971$ |
| 1.0523 | 1.0244 | $-.0905$ |
| 1.0592 | 1.0277 | $-.0824$ |
| 1.0673 | 1.0316 | $-.0734$ |
| 1.0733 | 1.0345 | $-.0669$ |
| 1.0804 | 1.0380 | $-.0597$ |
| 1.0870 | 1.0412 | $-.0533$ |
| 1.0942 | 1.0448 | $-.0466$ |
| 1.1007 | 1.0481 | $-.0408$ |
| 1.1076 | 1.0516 | $-.0350$ |
| 1.1145 | 1.0552 | $-.0294$ |
| 1.1205 | 1.0584 | $-.0249$ |
| 1.1276 | 1.0622 | $-.0198$ |
| 1.1344 | 1.0660 | $-.0153$ |
| 1.1414 | 1.0700 | $-.0110$ |
| 1.1480 | 1.0740 | $-.0072$ |
| 1.1548 | 1.0784 | $-.0038$ |
| 1.1616 | 1.0833 | $-.0010$ |
| 1.1650 | 1.0861 | $.0000$ |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0227 | .0853 | −.6799 | −1.1635 | .0868 |
| .0049 | .0818 | −.6720 | −1.1760 | .0842 |
| −.0198 | .0768 | −.6604 | −1.1936 | .0803 |
| −.0423 | .0721 | −.6492 | −1.2099 | .0764 |
| −.0629 | .0678 | −.6382 | −1.2250 | .0727 |
| −.0878 | .0625 | −.6241 | −1.2434 | .0679 |
| −.1046 | .0588 | −.6138 | −1.2561 | .0645 |
| −.1250 | .0543 | −.6006 | −1.2717 | .0602 |
| −.1390 | .0512 | −.5911 | −1.2824 | .0571 |
| −.1559 | .0473 | −.5789 | −1.2956 | .0532 |
| −.1747 | .0429 | −.5644 | −1.3105 | .0486 |
| −.1881 | .0398 | −.5534 | −1.3213 | .0452 |
| −.2031 | .0362 | −.5404 | −1.3334 | .0413 |
| −.2163 | .0330 | −.5282 | −1.3443 | .0378 |
| −.2301 | .0295 | −.5146 | −1.3559 | .0339 |
| −.2421 | .0265 | −.5023 | −1.3661 | .0304 |
| −.2540 | .0234 | −.4892 | −1.3765 | .0268 |
| −.2654 | .0204 | −.4760 | −1.3866 | .0232 |
| −.2747 | .0178 | −.4646 | −1.3952 | .0202 |
| −.2848 | .0149 | −.4516 | −1.4049 | .0166 |
| −.2936 | .0121 | −.4398 | −1.4141 | .0133 |
| −.3010 | .0094 | −.4295 | −1.4231 | .0101 |
| −.3062 | .0068 | −.4231 | −1.4316 | .0070 |
| −.3068 | .0042 | −.4265 | −1.4400 | .0040 |
| −.2910 | .0016 | −.4780 | −1.4483 | .0012 |
| .0000 | .0000 | −4.2769 | −1.4526 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0877 | −.6799 | −1.1720 |
| .0142 | −.0172 | .0839 | −.6697 | −1.1761 |
| .0349 | −.0410 | .0785 | −.6549 | −1.1814 |
| .0550 | −.0628 | .0735 | −.6408 | −1.1858 |
| .0744 | −.0827 | .0689 | −.6272 | −1.1895 |
| .0994 | −.1066 | .0633 | −.6098 | −1.1934 |
| .1174 | −.1229 | .0594 | −.5975 | −1.1957 |
| .1406 | −.1425 | .0546 | −.5817 | −1.1981 |
| .1573 | −.1559 | .0514 | −.5705 | −1.1995 |
| .1789 | −.1722 | .0474 | −.5563 | −1.2009 |
| .2046 | −.1902 | .0428 | −.5396 | −1.2020 |
| .2242 | −.2031 | .0396 | −.5271 | −1.2025 |
| .2477 | −.2174 | .0359 | −.5124 | −1.2027 |
| .2700 | −.2300 | .0326 | −.4989 | −1.2027 |
| .2954 | −.2432 | .0291 | −.4841 | −1.2023 |
| .3193 | −.2546 | .0261 | −.4706 | −1.2017 |
| .3455 | −.2659 | .0230 | −.4565 | −1.2009 |
| .3734 | −.2766 | .0200 | −.4425 | −1.1998 |
| .3994 | −.2854 | .0174 | −.4304 | −1.1987 |
| .4323 | −.2949 | .0145 | −.4167 | −1.1972 |
| .4675 | −.3029 | .0118 | −.4043 | −1.1956 |
| .5087 | −.3097 | .0091 | −.3933 | −1.1938 |
| .5577 | −.3140 | .0066 | −.3860 | −1.1920 |
| .6269 | −.3136 | .0041 | −.3877 | −1.1900 |
| .7704 | −.2962 | .0015 | −.4329 | −1.1881 |
| 5.9160 | .0000 | .0000 | −3.8666 | −1.1872 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-10.8307$ | $-.8642$ | .4065 |
| $-10.4697$ | $-.8658$ | .4631 |
| $-9.9524$ | $-.8685$ | .5425 |
| $-9.4617$ | $-.8715$ | .6159 |
| $-8.9951$ | $-.8749$ | .6838 |
| $-8.4072$ | $-.8797$ | .7666 |
| $-7.9894$ | $-.8835$ | .8234 |
| $-7.4602$ | $-.8888$ | .8927 |
| $-7.0823$ | $-.8928$ | .9402 |
| $-6.6015$ | $-.8982$ | .9982 |
| $-6.0337$ | $-.9049$ | 1.0627 |
| $-5.6032$ | $-.9102$ | 1.1085 |
| $-5.0911$ | $-.9167$ | 1.1594 |
| $-4.6047$ | $-.9229$ | 1.2038 |
| $-4.0502$ | $-.9300$ | 1.2495 |
| $-3.5229$ | $-.9367$ | 1.2880 |
| $-2.9363$ | $-.9439$ | 1.3251 |
| $-2.2961$ | $-.9514$ | 1.3585 |
| $-1.6804$ | $-.9580$ | 1.3842 |
| $-.8612$ | $-.9660$ | 1.4094 |
| .0850 | $-.9738$ | 1.4276 |
| 1.3197 | $-.9817$ | 1.4382 |
| 3.0482 | $-.9894$ | 1.4381 |
| 6.2315 | $-.9972$ | 1.4207 |
| 17.5517 | $-1.0047$ | 1.3600 |
| $+\infty$ | $-1.0082$ | 1.1063 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-9.4697$ | $-1.0088$ | .9135 | $-.1218$ |
| $-9.1934$ | $-1.0009$ | .9263 | $-.1325$ |
| $-8.7982$ | $-.9890$ | .9432 | $-.1456$ |
| $-8.4246$ | $-.9772$ | .9576 | $-.1558$ |
| $-8.0709$ | $-.9654$ | .9697 | $-.1634$ |
| $-7.6279$ | $-.9500$ | .9828 | $-.1703$ |
| $-7.3153$ | $-.9386$ | .9906 | $-.1733$ |
| $-6.9225$ | $-.9237$ | .9986 | $-.1752$ |
| $-6.6448$ | $-.9129$ | 1.0030 | $-.1751$ |
| $-6.2950$ | $-.8988$ | 1.0071 | $-.1736$ |
| $-5.8882$ | $-.8820$ | 1.0098 | $-.1698$ |
| $-5.5850$ | $-.8690$ | 1.0103 | $-.1656$ |
| $-5.2314$ | $-.8537$ | 1.0093 | $-.1593$ |
| $-4.9035$ | $-.8391$ | 1.0069 | $-.1522$ |
| $-4.5407$ | $-.8228$ | 1.0026 | $-.1432$ |
| $-4.2083$ | $-.8077$ | .9973 | $-.1339$ |
| $-3.8546$ | $-.7915$ | .9902 | $-.1230$ |
| $-3.4906$ | $-.7748$ | .9816 | $-.1110$ |
| $-3.1642$ | $-.7600$ | .9728 | $-.0997$ |
| $-2.7687$ | $-.7424$ | .9611 | $-.0855$ |
| $-2.3688$ | $-.7251$ | .9484 | $-.0709$ |
| $-1.9360$ | $-.7073$ | .9343 | $-.0554$ |
| $-1.4767$ | $-.6897$ | .9195 | $-.0397$ |
| $-.9419$ | $-.6715$ | .9035 | $-.0233$ |
| $-.2565$ | $-.6530$ | .8872 | $-.0070$ |
| .0000 | $-.6437$ | .8803 | .0000 |

**Ecoulement d'ordre 2
effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| $-.2377$ | .1319 | .2843 |
| $-.2542$ | .1316 | .2831 |
| $-.2766$ | .1311 | .2819 |
| $-.2965$ | .1308 | .2811 |
| $-.3143$ | .1306 | .2808 |
| $-.3352$ | .1304 | .2809 |
| $-.3492$ | .1303 | .2813 |
| $-.3659$ | .1303 | .2823 |
| $-.3773$ | .1303 | .2832 |
| $-.3912$ | .1304 | .2846 |
| $-.4069$ | .1306 | .2867 |
| $-.4186$ | .1308 | .2885 |
| $-.4324$ | .1310 | .2910 |
| $-.4457$ | .1313 | .2934 |
| $-.4613$ | .1317 | .2965 |
| $-.4770$ | .1321 | .2995 |
| $-.4960$ | .1325 | .3030 |
| $-.5191$ | .1330 | .3068 |
| $-.5442$ | .1334 | .3104 |
| $-.5830$ | .1339 | .3150 |
| $-.6361$ | .1345 | .3199 |
| $-.7197$ | .1350 | .3256 |
| $-.8617$ | .1356 | .3320 |
| $-1.1796$ | .1361 | .3403 |
| $-2.5512$ | .1365 | .3535 |
| $-\infty$ | .1366 | .3897 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .1015 | .3747 |
| −.0155 | .1004 | .3703 |
| −.0362 | .0989 | .3644 |
| −.0540 | .0976 | .3593 |
| −.0693 | .0965 | .3550 |
| −.0865 | .0951 | .3500 |
| −.0974 | .0943 | .3469 |
| −.1094 | .0933 | .3433 |
| −.1168 | .0926 | .3411 |
| −.1250 | .0919 | .3385 |
| −.1328 | .0911 | .3358 |
| −.1374 | .0906 | .3341 |
| −.1415 | .0900 | .3323 |
| −.1441 | .0896 | .3309 |
| −.1456 | .0891 | .3295 |
| −.1457 | .0888 | .3284 |
| −.1445 | .0885 | .3274 |
| −.1417 | .0882 | .3265 |
| −.1380 | .0880 | .3258 |
| −.1318 | .0879 | .3251 |
| −.1236 | .0877 | .3245 |
| −.1124 | .0876 | .3239 |
| −.0975 | .0875 | .3234 |
| −.0758 | .0875 | .3229 |
| −.0375 | .0874 | .3222 |
| .0000 | .0872 | .3218 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.2522$ | .1430 | .1383 | .2978 |
| $-.2470$ | .1473 | .1356 | .3096 |
| $-.2407$ | .1535 | .1318 | .3259 |
| $-.2361$ | .1593 | .1283 | .3407 |
| $-.2332$ | .1647 | .1250 | .3542 |
| $-.2316$ | .1714 | .1210 | .3703 |
| $-.2321$ | .1761 | .1182 | .3812 |
| $-.2347$ | .1819 | .1149 | .3944 |
| $-.2381$ | .1859 | .1126 | .4033 |
| $-.2444$ | .1909 | .1097 | .4141 |
| $-.2550$ | .1967 | .1066 | .4261 |
| $-.2655$ | .2009 | .1044 | .4347 |
| $-.2812$ | .2058 | .1020 | .4443 |
| $-.2996$ | .2102 | .0999 | .4528 |
| $-.3250$ | .2150 | .0977 | .4619 |
| $-.3541$ | .2192 | .0958 | .4699 |
| $-.3926$ | .2236 | .0941 | .4782 |
| $-.4425$ | .2280 | .0925 | .4865 |
| $-.4989$ | .2318 | .0913 | .4939 |
| $-.5870$ | .2361 | .0900 | .5027 |
| $-.7076$ | .2402 | .0891 | .5116 |
| $-.8934$ | .2443 | .0886 | .5216 |
| $-1.1991$ | .2483 | .0884 | .5328 |
| $-1.8563$ | .2522 | .0886 | .5474 |
| $-4.5531$ | .2561 | .0867 | .5716 |
| $-\infty$ | .2579 | $-.5683$ | .6403 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1110 | .1474 | .3937 |
| .0117 | .1140 | .1422 | .4039 |
| .0279 | .1180 | .1350 | .4177 |
| .0425 | .1216 | .1284 | .4299 |
| .0558 | .1250 | .1224 | .4406 |
| .0716 | .1289 | .1151 | .4530 |
| .0821 | .1315 | .1101 | .4610 |
| .0946 | .1347 | .1040 | .4703 |
| .1030 | .1368 | .0998 | .4764 |
| .1130 | .1394 | .0948 | .4834 |
| .1237 | .1422 | .0891 | .4909 |
| .1312 | .1442 | .0850 | .4959 |
| .1392 | .1464 | .0805 | .5011 |
| .1459 | .1483 | .0764 | .5055 |
| .1526 | .1503 | .0721 | .5098 |
| .1580 | .1520 | .0683 | .5132 |
| .1630 | .1537 | .0645 | .5164 |
| .1673 | .1552 | .0606 | .5192 |
| .1703 | .1566 | .0573 | .5213 |
| .1728 | .1580 | .0535 | .5234 |
| .1741 | .1594 | .0497 | .5252 |
| .1738 | .1606 | .0456 | .5266 |
| .1712 | .1618 | .0412 | .5277 |
| .1645 | .1630 | .0356 | .5286 |
| .1448 | .1641 | .0252 | .5292 |
| .0000 | .1647 | −.0180 | .5295 |

# tableaux 13

## $\alpha = 1.2$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|-------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9945 | .9840 | 1.0023 | .9941 |
| .9894 | .9685 | 1.0046 | .9886 |
| .9844 | .9534 | 1.0068 | .9833 |
| .9782 | .9341 | 1.0097 | .9768 |
| .9738 | .9200 | 1.0119 | .9722 |
| .9683 | .9020 | 1.0146 | .9664 |
| .9631 | .8845 | 1.0173 | .9611 |
| .9582 | .8677 | 1.0199 | .9561 |
| .9537 | .8515 | 1.0223 | .9515 |
| .9484 | .8319 | 1.0253 | .9461 |
| .9436 | .8131 | 1.0280 | .9412 |
| .9392 | .7951 | 1.0307 | .9368 |
| .9351 | .7778 | 1.0331 | .9327 |
| .9306 | .7579 | 1.0359 | .9283 |
| .9259 | .7357 | 1.0388 | .9237 |
| .9218 | .7147 | 1.0415 | .9197 |
| .9177 | .6920 | 1.0442 | .9157 |
| .9132 | .6653 | 1.0472 | .9115 |
| .9092 | .6380 | 1.0500 | .9077 |
| .9053 | .6082 | 1.0528 | .9042 |
| .9013 | .5728 | 1.0556 | .9008 |
| .8974 | .5289 | 1.0585 | .8975 |
| .8936 | .4710 | 1.0613 | .8946 |
| .8898 | .3694 | 1.0641 | .8921 |
| .8880 | .0382 | 1.0656 | .8912 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0078 | 1.0051 | $-.1871$ |
| 1.0154 | 1.0100 | $-.1750$ |
| 1.0228 | 1.0147 | $-.1638$ |
| 1.0322 | 1.0208 | $-.1499$ |
| 1.0391 | 1.0252 | $-.1404$ |
| 1.0479 | 1.0308 | $-.1286$ |
| 1.0563 | 1.0362 | $-.1179$ |
| 1.0643 | 1.0412 | $-.1081$ |
| 1.0719 | 1.0461 | $-.0992$ |
| 1.0810 | 1.0518 | $-.0891$ |
| 1.0895 | 1.0571 | $-.0800$ |
| 1.0974 | 1.0621 | $-.0719$ |
| 1.1048 | 1.0667 | $-.0647$ |
| 1.1131 | 1.0719 | $-.0570$ |
| 1.1219 | 1.0773 | $-.0493$ |
| 1.1298 | 1.0823 | $-.0426$ |
| 1.1379 | 1.0874 | $-.0362$ |
| 1.1467 | 1.0930 | $-.0296$ |
| 1.1549 | 1.0982 | $-.0238$ |
| 1.1629 | 1.1034 | $-.0185$ |
| 1.1712 | 1.1089 | $-.0134$ |
| 1.1796 | 1.1146 | $-.0087$ |
| 1.1877 | 1.1204 | $-.0046$ |
| 1.1959 | 1.1267 | $-.0012$ |
| 1.2000 | 1.1302 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0214 | .1040 | $-.7046$ | $-1.1724$ | .1062 |
| $-.0020$ | .0983 | $-.6954$ | $-1.1926$ | .1018 |
| $-.0236$ | .0930 | $-.6865$ | $-1.2116$ | .0974 |
| $-.0435$ | .0880 | $-.6777$ | $-1.2293$ | .0931 |
| $-.0677$ | .0818 | $-.6663$ | $-1.2513$ | .0876 |
| $-.0844$ | .0775 | $-.6579$ | $-1.2666$ | .0836 |
| $-.1047$ | .0721 | $-.6470$ | $-1.2856$ | .0785 |
| $-.1232$ | .0672 | $-.6365$ | $-1.3032$ | .0736 |
| $-.1400$ | .0626 | $-.6263$ | $-1.3194$ | .0690 |
| $-.1553$ | .0583 | $-.6165$ | $-1.3343$ | .0646 |
| $-.1726$ | .0534 | $-.6047$ | $-1.3515$ | .0594 |
| $-.1880$ | .0490 | $-.5935$ | $-1.3670$ | .0547 |
| $-.2018$ | .0449 | $-.5829$ | $-1.3811$ | .0503 |
| $-.2143$ | .0413 | $-.5729$ | $-1.3940$ | .0462 |
| $-.2275$ | .0373 | $-.5618$ | $-1.4078$ | .0417 |
| $-.2409$ | .0332 | $-.5498$ | $-1.4221$ | .0370 |
| $-.2525$ | .0295 | $-.5390$ | $-1.4346$ | .0328 |
| $-.2638$ | .0259 | $-.5281$ | $-1.4470$ | .0287 |
| $-.2754$ | .0221 | $-.5165$ | $-1.4602$ | .0242 |
| $-.2856$ | .0186 | $-.5062$ | $-1.4721$ | .0201 |
| $-.2947$ | .0153 | $-.4972$ | $-1.4834$ | .0162 |
| $-.3031$ | .0120 | $-.4899$ | $-1.4948$ | .0123 |
| $-.3097$ | .0086 | $-.4870$ | $-1.5060$ | .0085 |
| $-.3125$ | .0054 | $-.4959$ | $-1.5168$ | .0049 |
| $-.3010$ | .0020 | $-.5592$ | $-1.5273$ | .0015 |
| .0000 | .0000 | $-4.9235$ | $-1.5327$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1070 | −.7046 | −1.1804 |
| .0194 | −.0227 | .1008 | −.6917 | −1.1872 |
| .0384 | −.0436 | .0950 | −.6792 | −1.1930 |
| .0569 | −.0629 | .0896 | −.6671 | −1.1980 |
| .0808 | −.0864 | .0829 | −.6517 | −1.2035 |
| .0982 | −.1024 | .0782 | −.6407 | −1.2070 |
| .1208 | −.1221 | .0725 | −.6265 | −1.2108 |
| .1426 | −.1399 | .0672 | −.6130 | −1.2138 |
| .1638 | −.1562 | .0624 | −.6001 | −1.2162 |
| .1843 | −.1709 | .0580 | −.5879 | −1.2180 |
| .2090 | −.1876 | .0529 | −.5735 | −1.2197 |
| .2327 | −.2024 | .0483 | −.5600 | −1.2208 |
| .2556 | −.2157 | .0442 | −.5475 | −1.2215 |
| .2775 | −.2276 | .0405 | −.5357 | −1.2219 |
| .3028 | −.2403 | .0364 | −.5228 | −1.2219 |
| .3309 | −.2531 | .0323 | −.5091 | −1.2217 |
| .3575 | −.2642 | .0287 | −.4969 | −1.2212 |
| .3863 | −.2749 | .0251 | −.4846 | −1.2204 |
| .4201 | −.2859 | .0213 | −.4717 | −1.2193 |
| .4546 | −.2955 | .0179 | −.4603 | −1.2181 |
| .4924 | −.3040 | .0147 | −.4501 | −1.2166 |
| .5375 | −.3116 | .0114 | −.4416 | −1.2150 |
| .5947 | −.3175 | .0082 | −.4370 | −1.2132 |
| .6742 | −.3193 | .0051 | −.4431 | −1.2113 |
| .8407 | −.3063 | .0019 | −.4976 | −1.2094 |
| 6.7978 | .0000 | .0000 | −4.3720 | −1.2085 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-8.8954$ | $-.8509$ | .4884 |
| $-8.5098$ | $-.8543$ | .5500 |
| $-8.1412$ | $-.8581$ | .6078 |
| $-7.7883$ | $-.8620$ | .6622 |
| $-7.3401$ | $-.8676$ | .7298 |
| $-7.0192$ | $-.8719$ | .7770 |
| $-6.6099$ | $-.8777$ | .8358 |
| $-6.2201$ | $-.8837$ | .8900 |
| $-5.8479$ | $-.8896$ | .9400 |
| $-5.4918$ | $-.8956$ | .9861 |
| $-5.0670$ | $-.9029$ | 1.0386 |
| $-4.6626$ | $-.9101$ | 1.0858 |
| $-4.2762$ | $-.9170$ | 1.1281 |
| $-3.9059$ | $-.9237$ | 1.1660 |
| $-3.4799$ | $-.9314$ | 1.2061 |
| $-3.0049$ | $-.9398$ | 1.2461 |
| $-2.5493$ | $-.9475$ | 1.2798 |
| $-2.0478$ | $-.9556$ | 1.3114 |
| $-1.4419$ | $-.9646$ | 1.3422 |
| $-.7926$ | $-.9732$ | 1.3670 |
| $-.0346$ | $-.9817$ | 1.3865 |
| .9652 | $-.9905$ | 1.4004 |
| 2.4459 | $-.9994$ | 1.4055 |
| 5.1093 | $-1.0082$ | 1.3957 |
| 14.6607 | $-1.0167$ | 1.3490 |
| $+\infty$ | $-1.0208$ | 1.1216 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-7.8125$ | $-1.0056$ | .8906 | $-.1485$ |
| $-7.5134$ | $-.9948$ | .9047 | $-.1603$ |
| $-7.2283$ | $-.9840$ | .9170 | $-.1695$ |
| $-6.9564$ | $-.9732$ | .9278 | $-.1766$ |
| $-6.6127$ | $-.9588$ | .9400 | $-.1831$ |
| $-6.3682$ | $-.9481$ | .9476 | $-.1862$ |
| $-6.0586$ | $-.9341$ | .9559 | $-.1882$ |
| $-5.7663$ | $-.9204$ | .9624 | $-.1882$ |
| $-5.4902$ | $-.9069$ | .9672 | $-.1867$ |
| $-5.2290$ | $-.8938$ | .9705 | $-.1838$ |
| $-4.9221$ | $-.8780$ | .9729 | $-.1789$ |
| $-4.6351$ | $-.8628$ | .9737 | $-.1728$ |
| $-4.3666$ | $-.8482$ | .9732 | $-.1659$ |
| $-4.1151$ | $-.8344$ | .9715 | $-.1584$ |
| $-3.8339$ | $-.8187$ | .9685 | $-.1491$ |
| $-3.5318$ | $-.8017$ | .9637 | $-.1380$ |
| $-3.2550$ | $-.7860$ | .9582 | $-.1270$ |
| $-2.9666$ | $-.7698$ | .9513 | $-.1149$ |
| $-2.6435$ | $-.7517$ | .9424 | $-.1008$ |
| $-2.3301$ | $-.7345$ | .9329 | $-.0868$ |
| $-2.0086$ | $-.7174$ | .9224 | $-.0723$ |
| $-1.6551$ | $-.6996$ | .9104 | $-.0567$ |
| $-1.2588$ | $-.6811$ | .8971 | $-.0403$ |
| $-.8102$ | $-.6627$ | .8833 | $-.0237$ |
| $-.2273$ | $-.6440$ | .8691 | $-.0072$ |
| .0000 | $-.6345$ | .8629 | .0000 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|:---:|:---:|:---:|
| $-.1961$ | .1415 | .3144 |
| $-.2179$ | .1408 | .3131 |
| $-.2375$ | .1403 | .3122 |
| $-.2552$ | .1399 | .3117 |
| $-.2761$ | .1395 | .3115 |
| $-.2902$ | .1393 | .3117 |
| $-.3071$ | .1391 | .3123 |
| $-.3221$ | .1390 | .3133 |
| $-.3357$ | .1390 | .3145 |
| $-.3480$ | .1391 | .3159 |
| $-.3620$ | .1392 | .3179 |
| $-.3749$ | .1394 | .3200 |
| $-.3870$ | .1397 | .3223 |
| $-.3985$ | .1399 | .3246 |
| $-.4119$ | .1403 | .3275 |
| $-.4275$ | .1407 | .3308 |
| $-.4435$ | .1411 | .3341 |
| $-.4628$ | .1416 | .3377 |
| $-.4890$ | .1422 | .3420 |
| $-.5217$ | .1427 | .3463 |
| $-.5664$ | .1433 | .3510 |
| $-.6370$ | .1439 | .3564 |
| $-.7641$ | .1445 | .3627 |
| $-1.0430$ | .1451 | .3705 |
| $-2.2580$ | .1456 | .3828 |
| $-\infty$ | .1456 | .4173 |

| $\rho_{23}^\star$ | $u_{23}^\star$ | $p_{23}^\star$ |
|---|---|---|
| .0000 | .1070 | .3881 |
| −.0202 | .1053 | .3823 |
| −.0380 | .1038 | .3771 |
| −.0536 | .1024 | .3726 |
| −.0715 | .1008 | .3674 |
| −.0831 | .0998 | .3640 |
| −.0963 | .0986 | .3600 |
| −.1073 | .0975 | .3567 |
| −.1164 | .0966 | .3538 |
| −.1239 | .0958 | .3514 |
| −.1313 | .0950 | .3488 |
| −.1369 | .0943 | .3467 |
| −.1410 | .0937 | .3449 |
| −.1437 | .0933 | .3434 |
| −.1456 | .0928 | .3419 |
| −.1463 | .0924 | .3405 |
| −.1457 | .0920 | .3393 |
| −.1437 | .0917 | .3383 |
| −.1398 | .0915 | .3373 |
| −.1345 | .0913 | .3364 |
| −.1272 | .0911 | .3357 |
| −.1169 | .0910 | .3349 |
| −.1024 | .0909 | .3342 |
| −.0814 | .0908 | .3335 |
| −.0433 | .0907 | .3327 |
| .0000 | .0905 | .3321 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.1908$ | .1423 | .1354 | .3195 |
| $-.1839$ | .1490 | .1325 | .3367 |
| $-.1784$ | .1554 | .1298 | .3525 |
| $-.1742$ | .1614 | .1273 | .3671 |
| $-.1704$ | .1689 | .1243 | .3849 |
| $-.1688$ | .1742 | .1222 | .3970 |
| $-.1684$ | .1808 | .1197 | .4118 |
| $-.1698$ | .1870 | .1174 | .4252 |
| $-.1728$ | .1928 | .1154 | .4374 |
| $-.1774$ | .1982 | .1136 | .4485 |
| $-.1853$ | .2044 | .1117 | .4609 |
| $-.1954$ | .2102 | .1100 | .4721 |
| $-.2078$ | .2155 | .1086 | .4820 |
| $-.2223$ | .2204 | .1074 | .4910 |
| $-.2425$ | .2258 | .1062 | .5006 |
| $-.2699$ | .2314 | .1051 | .5106 |
| $-.3013$ | .2364 | .1044 | .5193 |
| $-.3423$ | .2415 | .1038 | .5281 |
| $-.4013$ | .2469 | .1034 | .5376 |
| $-.4764$ | .2520 | .1033 | .5467 |
| $-.5798$ | .2568 | .1035 | .5558 |
| $-.7402$ | .2618 | .1041 | .5659 |
| $-1.0201$ | .2668 | .1051 | .5776 |
| $-1.6086$ | .2716 | .1064 | .5918 |
| $-4.0402$ | .2764 | .1042 | .6149 |
| $-\infty$ | .2787 | $-1.2961$ | .6816 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1086 | .1440 | .3913 |
| .0153 | .1132 | .1379 | .4062 |
| .0294 | .1174 | .1323 | .4195 |
| .0423 | .1213 | .1270 | .4314 |
| .0578 | .1260 | .1207 | .4454 |
| .0684 | .1292 | .1163 | .4546 |
| .0812 | .1330 | .1109 | .4655 |
| .0926 | .1364 | .1061 | .4749 |
| .1028 | .1395 | .1017 | .4831 |
| .1120 | .1423 | .0976 | .4903 |
| .1220 | .1454 | .0931 | .4980 |
| .1307 | .1482 | .0890 | .5044 |
| .1382 | .1506 | .0853 | .5099 |
| .1447 | .1528 | .0820 | .5146 |
| .1514 | .1550 | .0784 | .5192 |
| .1577 | .1573 | .0748 | .5236 |
| .1628 | .1593 | .0715 | .5271 |
| .1672 | .1612 | .0682 | .5303 |
| .1713 | .1631 | .0647 | .5333 |
| .1741 | .1649 | .0613 | .5357 |
| .1758 | .1665 | .0579 | .5378 |
| .1761 | .1680 | .0541 | .5395 |
| .1742 | .1696 | .0496 | .5409 |
| .1682 | .1711 | .0437 | .5421 |
| .1494 | .1725 | .0318 | .5429 |
| .0000 | .1732 | $-.0440$ | .5433 |

# tableaux 14

## $\alpha = 1.2$ et $\gamma = 1.67$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|---|---|---|---|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9922 | .9882 | 1.0040 | .9961 |
| .9829 | .9738 | 1.0088 | .9914 |
| .9741 | .9596 | 1.0136 | .9869 |
| .9658 | .9458 | 1.0182 | .9826 |
| .9580 | .9322 | 1.0228 | .9785 |
| .9505 | .9189 | 1.0272 | .9745 |
| .9422 | .9033 | 1.0323 | .9699 |
| .9356 | .8905 | 1.0364 | .9662 |
| .9282 | .8755 | 1.0412 | .9620 |
| .9213 | .8608 | 1.0457 | .9580 |
| .9138 | .8440 | 1.0508 | .9537 |
| .9069 | .8275 | 1.0556 | .9495 |
| .9005 | .8115 | 1.0602 | .9457 |
| .8946 | .7958 | 1.0644 | .9421 |
| .8878 | .7762 | 1.0696 | .9379 |
| .8817 | .7572 | 1.0743 | .9340 |
| .8757 | .7367 | 1.0790 | .9302 |
| .8699 | .7150 | 1.0836 | .9266 |
| .8641 | .6903 | 1.0884 | .9229 |
| .8585 | .6633 | 1.0931 | .9193 |
| .8530 | .6312 | 1.0979 | .9159 |
| .8477 | .5924 | 1.1025 | .9126 |
| .8424 | .5391 | 1.1073 | .9095 |
| .8373 | .4426 | 1.1120 | .9067 |
| .8347 | .0521 | 1.1144 | .9057 |

| $u_0$ | $p_0$ | $\psi_0$ |
|-------|-------|----------|
| 1.0000 | 1.0000 | $-.3350$ |
| 1.0119 | 1.0119 | $-.3143$ |
| 1.0264 | 1.0262 | $-.2903$ |
| 1.0405 | 1.0401 | $-.2681$ |
| 1.0543 | 1.0534 | $-.2477$ |
| 1.0677 | 1.0662 | $-.2287$ |
| 1.0806 | 1.0785 | $-.2112$ |
| 1.0956 | 1.0926 | $-.1919$ |
| 1.1077 | 1.1038 | $-.1772$ |
| 1.1217 | 1.1166 | $-.1609$ |
| 1.1351 | 1.1288 | $-.1461$ |
| 1.1500 | 1.1421 | $-.1304$ |
| 1.1640 | 1.1546 | $-.1164$ |
| 1.1773 | 1.1662 | $-.1038$ |
| 1.1898 | 1.1771 | $-.0925$ |
| 1.2047 | 1.1899 | $-.0797$ |
| 1.2184 | 1.2015 | $-.0686$ |
| 1.2322 | 1.2131 | $-.0581$ |
| 1.2457 | 1.2244 | $-.0483$ |
| 1.2596 | 1.2360 | $-.0389$ |
| 1.2732 | 1.2472 | $-.0302$ |
| 1.2870 | 1.2587 | $-.0220$ |
| 1.3006 | 1.2700 | $-.0146$ |
| 1.3144 | 1.2815 | $-.0079$ |
| 1.3281 | 1.2934 | $-.0021$ |
| 1.3350 | 1.2998 | $.0000$ |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0173 | .1774 | −.7995 | −1.2037 | .1835 |
| −.0032 | .1692 | −.7964 | −1.2342 | .1761 |
| −.0268 | .1595 | −.7925 | −1.2705 | .1671 |
| −.0484 | .1504 | −.7886 | −1.3047 | .1582 |
| −.0683 | .1419 | −.7846 | −1.3370 | .1496 |
| −.0868 | .1338 | −.7807 | −1.3676 | .1413 |
| −.1038 | .1262 | −.7767 | −1.3965 | .1333 |
| −.1227 | .1175 | −.7720 | −1.4292 | .1241 |
| −.1372 | .1108 | −.7681 | −1.4548 | .1168 |
| −.1532 | .1032 | −.7635 | −1.4838 | .1084 |
| −.1680 | .0960 | −.7590 | −1.5108 | .1006 |
| −.1838 | .0882 | −.7539 | −1.5401 | .0920 |
| −.1982 | .0810 | −.7491 | −1.5672 | .0840 |
| −.2113 | .0744 | −.7446 | −1.5921 | .0765 |
| −.2233 | .0682 | −.7404 | −1.6151 | .0697 |
| −.2371 | .0610 | −.7355 | −1.6419 | .0617 |
| −.2494 | .0545 | −.7313 | −1.6658 | .0545 |
| −.2615 | .0480 | −.7274 | −1.6894 | .0474 |
| −.2731 | .0417 | −.7244 | −1.7120 | .0406 |
| −.2847 | .0353 | −.7224 | −1.7348 | .0337 |
| −.2958 | .0292 | −.7223 | −1.7564 | .0272 |
| −.3068 | .0229 | −.7256 | −1.7781 | .0207 |
| −.3170 | .0168 | −.7356 | −1.7988 | .0145 |
| −.3259 | .0105 | −.7623 | −1.8193 | .0085 |
| −.3276 | .0039 | −.8606 | −1.8394 | .0027 |
| .0000 | .0000 | −6.8543 | −1.8494 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1832 | −.7995 | −1.2094 |
| .0190 | −.0201 | .1736 | −.7902 | −1.2205 |
| .0423 | −.0432 | .1623 | −.7790 | −1.2327 |
| .0653 | −.0644 | .1519 | −.7682 | −1.2431 |
| .0880 | −.0840 | .1422 | −.7578 | −1.2520 |
| .1103 | −.1020 | .1332 | −.7478 | −1.2597 |
| .1323 | −.1187 | .1248 | −.7383 | −1.2662 |
| .1583 | −.1371 | .1154 | −.7273 | −1.2728 |
| .1797 | −.1512 | .1082 | −.7186 | −1.2775 |
| .2050 | −.1669 | .1000 | −.7086 | −1.2821 |
| .2300 | −.1813 | .0925 | −.6992 | −1.2858 |
| .2586 | −.1966 | .0845 | −.6889 | −1.2893 |
| .2868 | −.2106 | .0771 | −.6793 | −1.2919 |
| .3145 | −.2233 | .0703 | −.6705 | −1.2939 |
| .3418 | −.2349 | .0641 | −.6624 | −1.2953 |
| .3762 | −.2483 | .0570 | −.6530 | −1.2965 |
| .4100 | −.2602 | .0506 | −.6448 | −1.2971 |
| .4466 | −.2718 | .0443 | −.6370 | −1.2973 |
| .4859 | −.2829 | .0383 | −.6301 | −1.2971 |
| .5311 | −.2941 | .0322 | −.6242 | −1.2966 |
| .5816 | −.3046 | .0265 | −.6201 | −1.2957 |
| .6431 | −.3150 | .0207 | −.6190 | −1.2946 |
| .7202 | −.3246 | .0150 | −.6236 | −1.2931 |
| .8331 | −.3327 | .0093 | −.6422 | −1.2914 |
| 1.0722 | −.3331 | .0035 | −.7205 | −1.2895 |
| 9.3496 | .0000 | .0000 | −5.7215 | −1.2886 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-5.2277$ | $-.8056$ | .6340 |
| $-5.0409$ | $-.8133$ | .6664 |
| $-4.8150$ | $-.8230$ | .7060 |
| $-4.5970$ | $-.8325$ | .7445 |
| $-4.3862$ | $-.8420$ | .7819 |
| $-4.1821$ | $-.8514$ | .8182 |
| $-3.9841$ | $-.8606$ | .8534 |
| $-3.7539$ | $-.8716$ | .8942 |
| $-3.5678$ | $-.8805$ | .9269 |
| $-3.3508$ | $-.8910$ | .9646 |
| $-3.1400$ | $-.9012$ | 1.0005 |
| $-2.9013$ | $-.9128$ | 1.0401 |
| $-2.6694$ | $-.9240$ | 1.0772 |
| $-2.4435$ | $-.9346$ | 1.1117 |
| $-2.2227$ | $-.9449$ | 1.1437 |
| $-1.9451$ | $-.9573$ | 1.1811 |
| $-1.6730$ | $-.9688$ | 1.2144 |
| $-1.3749$ | $-.9807$ | 1.2468 |
| $-1.0493$ | $-.9924$ | 1.2772 |
| $-.6633$ | $-1.0047$ | 1.3065 |
| $-.2094$ | $-1.0168$ | 1.3325 |
| .3921 | $-1.0293$ | 1.3554 |
| 1.2584 | $-1.0417$ | 1.3727 |
| 2.8784 | $-1.0542$ | 1.3807 |
| 8.8785 | $-1.0667$ | 1.3641 |
| $+\infty$ | $-1.0728$ | 1.1867 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −4.6642 | −.9951 | .8213 | −.2534 |
| −4.5118 | −.9854 | .8293 | −.2559 |
| −4.3285 | −.9730 | .8383 | −.2569 |
| −4.1527 | −.9604 | .8465 | −.2560 |
| −3.9841 | −.9478 | .8537 | −.2534 |
| −3.8223 | −.9351 | .8600 | −.2495 |
| −3.6668 | −.9224 | .8654 | −.2445 |
| −3.4881 | −.9073 | .8707 | −.2373 |
| −3.3455 | −.8949 | .8743 | −.2306 |
| −3.1814 | −.8801 | .8775 | −.2218 |
| −3.0247 | −.8656 | .8798 | −.2124 |
| −2.8507 | −.8491 | .8814 | −.2010 |
| −2.6857 | −.8332 | .8819 | −.1894 |
| −2.5291 | −.8178 | .8814 | −.1777 |
| −2.3806 | −.8030 | .8802 | −.1661 |
| −2.2007 | −.7850 | .8777 | −.1515 |
| −2.0326 | −.7682 | .8744 | −.1376 |
| −1.8589 | −.7509 | .8701 | −.1229 |
| −1.6827 | −.7335 | .8649 | −.1081 |
| −1.4929 | −.7153 | .8586 | −.0922 |
| −1.2970 | −.6972 | .8515 | −.0763 |
| −1.0807 | −.6784 | .8433 | −.0596 |
| −.8435 | −.6596 | .8344 | −.0427 |
| −.5608 | −.6402 | .8245 | −.0254 |
| −.1749 | −.6205 | .8140 | −.0080 |
| .0000 | −.6104 | .8092 | .0000 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| $-.1138$ | .1774 | .4022 |
| $-.1333$ | .1765 | .4027 |
| $-.1552$ | .1756 | .4036 |
| $-.1747$ | .1749 | .4049 |
| $-.1923$ | .1744 | .4065 |
| $-.2081$ | .1740 | .4082 |
| $-.2224$ | .1737 | .4102 |
| $-.2378$ | .1736 | .4127 |
| $-.2495$ | .1736 | .4150 |
| $-.2622$ | .1737 | .4178 |
| $-.2739$ | .1739 | .4208 |
| $-.2863$ | .1742 | .4242 |
| $-.2978$ | .1747 | .4277 |
| $-.3086$ | .1751 | .4312 |
| $-.3190$ | .1756 | .4347 |
| $-.3321$ | .1763 | .4391 |
| $-.3453$ | .1770 | .4433 |
| $-.3606$ | .1778 | .4477 |
| $-.3787$ | .1786 | .4524 |
| $-.4027$ | .1795 | .4574 |
| $-.4353$ | .1804 | .4626 |
| $-.4863$ | .1813 | .4684 |
| $-.5745$ | .1822 | .4748 |
| $-.7752$ | .1831 | .4824 |
| $-1.6840$ | .1839 | .4936 |
| $-\infty$ | .1840 | .5274 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .1268 | .4365 |
| −.0173 | .1246 | .4315 |
| −.0364 | .1222 | .4260 |
| −.0531 | .1200 | .4211 |
| −.0677 | .1181 | .4167 |
| −.0805 | .1165 | .4128 |
| −.0917 | .1150 | .4093 |
| −.1031 | .1135 | .4055 |
| −.1113 | .1124 | .4027 |
| −.1196 | .1113 | .3998 |
| −.1265 | .1103 | .3971 |
| −.1329 | .1093 | .3944 |
| −.1378 | .1085 | .3920 |
| −.1415 | .1079 | .3899 |
| −.1440 | .1074 | .3880 |
| −.1459 | .1068 | .3859 |
| −.1465 | .1064 | .3841 |
| −.1459 | .1061 | .3824 |
| −.1440 | .1058 | .3808 |
| −.1404 | .1056 | .3792 |
| −.1351 | .1054 | .3777 |
| −.1270 | .1053 | .3762 |
| −.1153 | .1052 | .3747 |
| −.0968 | .1051 | .3732 |
| −.0594 | .1049 | .3716 |
| .0000 | .1047 | .3705 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.0809$ | .1401 | .1260 | .3606 |
| $-.0745$ | .1492 | .1255 | .3822 |
| $-.0677$ | .1601 | .1251 | .4074 |
| $-.0622$ | .1704 | .1249 | .4310 |
| $-.0580$ | .1802 | .1250 | .4530 |
| $-.0549$ | .1896 | .1252 | .4735 |
| $-.0529$ | .1986 | .1256 | .4927 |
| $-.0521$ | .2088 | .1263 | .5140 |
| $-.0525$ | .2170 | .1270 | .5306 |
| $-.0545$ | .2262 | .1281 | .5490 |
| $-.0580$ | .2350 | .1293 | .5659 |
| $-.0639$ | .2447 | .1309 | .5841 |
| $-.0719$ | .2538 | .1326 | .6006 |
| $-.0819$ | .2623 | .1345 | .6156 |
| $-.0940$ | .2703 | .1365 | .6293 |
| $-.1128$ | .2797 | .1391 | .6451 |
| $-.1353$ | .2884 | .1418 | .6591 |
| $-.1649$ | .2971 | .1448 | .6729 |
| $-.2036$ | .3056 | .1482 | .6862 |
| $-.2580$ | .3144 | .1520 | .6997 |
| $-.3341$ | .3229 | .1561 | .7128 |
| $-.4532$ | .3316 | .1608 | .7266 |
| $-.6554$ | .3403 | .1658 | .7410 |
| $-1.0977$ | .3490 | .1707 | .7576 |
| $-2.9877$ | .3578 | .1673 | .7815 |
| $-\infty$ | .3621 | $-4.1967$ | .8502 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1006 | .1329 | .3839 |
| .0129 | .1072 | .1296 | .4020 |
| .0280 | .1147 | .1259 | .4222 |
| .0418 | .1216 | .1226 | .4403 |
| .0546 | .1279 | .1197 | .4564 |
| .0663 | .1336 | .1170 | .4707 |
| .0771 | .1389 | .1146 | .4836 |
| .0890 | .1446 | .1120 | .4973 |
| .0980 | .1490 | .1101 | .5074 |
| .1078 | .1538 | .1080 | .5182 |
| .1167 | .1582 | .1061 | .5276 |
| .1260 | .1628 | .1042 | .5372 |
| .1343 | .1670 | .1024 | .5455 |
| .1415 | .1707 | .1008 | .5526 |
| .1479 | .1741 | .0994 | .5587 |
| .1549 | .1779 | .0977 | .5653 |
| .1607 | .1813 | .0962 | .5708 |
| .1661 | .1846 | .0946 | .5757 |
| .1707 | .1877 | .0929 | .5801 |
| .1746 | .1907 | .0910 | .5841 |
| .1776 | .1936 | .0888 | .5875 |
| .1794 | .1965 | .0860 | .5906 |
| .1793 | .1992 | .0820 | .5932 |
| .1755 | .2020 | .0755 | .5954 |
| .1590 | .2047 | .0586 | .5973 |
| .0000 | .2060 | $-.1825$ | .5983 |

# tableaux 15

## $\alpha = 1.4$ et $\gamma = 1.33$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|---------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9960 | .9905 | 1.0024 | .9975 |
| .9922 | .9811 | 1.0048 | .9949 |
| .9885 | .9718 | 1.0071 | .9925 |
| .9850 | .9625 | 1.0094 | .9901 |
| .9800 | .9488 | 1.0127 | .9865 |
| .9768 | .9397 | 1.0148 | .9842 |
| .9722 | .9263 | 1.0178 | .9809 |
| .9693 | .9175 | 1.0198 | .9787 |
| .9652 | .9044 | 1.0226 | .9756 |
| .9614 | .8915 | 1.0252 | .9726 |
| .9578 | .8788 | 1.0278 | .9698 |
| .9544 | .8663 | 1.0302 | .9671 |
| .9503 | .8500 | 1.0332 | .9638 |
| .9475 | .8380 | 1.0353 | .9615 |
| .9440 | .8223 | 1.0379 | .9586 |
| .9400 | .8032 | 1.0408 | .9553 |
| .9366 | .7848 | 1.0435 | .9524 |
| .9336 | .7669 | 1.0458 | .9498 |
| .9299 | .7429 | 1.0487 | .9467 |
| .9269 | .7200 | 1.0511 | .9442 |
| .9235 | .6892 | 1.0539 | .9414 |
| .9203 | .6522 | 1.0565 | .9387 |
| .9172 | .6017 | 1.0591 | .9363 |
| .9140 | .5057 | 1.0618 | .9340 |
| .9125 | .0361 | 1.0631 | .9331 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | −.1650 |
| 1.0064 | 1.0054 | −.1558 |
| 1.0127 | 1.0106 | −.1471 |
| 1.0188 | 1.0156 | −.1388 |
| 1.0248 | 1.0204 | −.1310 |
| 1.0334 | 1.0273 | −.1199 |
| 1.0389 | 1.0316 | −.1130 |
| 1.0469 | 1.0378 | −.1034 |
| 1.0520 | 1.0416 | −.0974 |
| 1.0594 | 1.0472 | −.0890 |
| 1.0664 | 1.0523 | −.0812 |
| 1.0731 | 1.0572 | −.0741 |
| 1.0794 | 1.0617 | −.0676 |
| 1.0872 | 1.0672 | −.0597 |
| 1.0927 | 1.0711 | −.0544 |
| 1.0995 | 1.0758 | −.0480 |
| 1.1072 | 1.0810 | −.0410 |
| 1.1141 | 1.0857 | −.0350 |
| 1.1203 | 1.0898 | −.0299 |
| 1.1277 | 1.0948 | −.0240 |
| 1.1340 | 1.0989 | −.0192 |
| 1.1411 | 1.1037 | −.0140 |
| 1.1479 | 1.1083 | −.0094 |
| 1.1547 | 1.1129 | −.0052 |
| 1.1616 | 1.1179 | −.0014 |
| 1.1650 | 1.1206 | .0000 |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0327 | .0671 | −.6629 | −1.1380 | .0890 |
| .0191 | .0634 | −.6539 | −1.1519 | .0850 |
| .0063 | .0600 | −.6450 | −1.1651 | .0811 |
| −.0059 | .0568 | −.6361 | −1.1777 | .0773 |
| −.0175 | .0537 | −.6273 | −1.1896 | .0737 |
| −.0339 | .0494 | −.6141 | −1.2064 | .0685 |
| −.0441 | .0467 | −.6055 | −1.2170 | .0651 |
| −.0587 | .0429 | −.5927 | −1.2318 | .0604 |
| −.0678 | .0405 | −.5842 | −1.2410 | .0574 |
| −.0808 | .0372 | −.5718 | −1.2540 | .0531 |
| −.0929 | .0341 | −.5596 | −1.2661 | .0491 |
| −.1042 | .0313 | −.5477 | −1.2772 | .0454 |
| −.1148 | .0287 | −.5361 | −1.2875 | .0419 |
| −.1279 | .0256 | −.5212 | −1.3001 | .0376 |
| −.1371 | .0235 | −.5104 | −1.3086 | .0347 |
| −.1484 | .0209 | −.4967 | −1.3190 | .0311 |
| −.1612 | .0181 | −.4805 | −1.3305 | .0270 |
| −.1727 | .0156 | −.4654 | −1.3405 | .0235 |
| −.1831 | .0135 | −.4516 | −1.3492 | .0204 |
| −.1959 | .0111 | −.4341 | −1.3595 | .0168 |
| −.2070 | .0091 | −.4190 | −1.3679 | .0138 |
| −.2201 | .0069 | −.4011 | −1.3774 | .0104 |
| −.2333 | .0049 | −.3839 | −1.3862 | .0073 |
| −.2473 | .0029 | −.3685 | −1.3947 | .0043 |
| −.2614 | .0010 | −.3678 | −1.4032 | .0013 |
| .0000 | .0000 | −4.3669 | −1.4073 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0756 | −.6629 | −1.1468 |
| .0162 | −.0130 | .0714 | −.6513 | −1.1514 |
| .0321 | −.0253 | .0675 | −.6400 | −1.1555 |
| .0478 | −.0370 | .0638 | −.6288 | −1.1590 |
| .0633 | −.0481 | .0603 | −.6179 | −1.1622 |
| .0862 | −.0637 | .0554 | −.6018 | −1.1662 |
| .1012 | −.0735 | .0523 | −.5914 | −1.1684 |
| .1232 | −.0873 | .0481 | −.5762 | −1.1713 |
| .1377 | −.0960 | .0454 | −.5663 | −1.1728 |
| .1589 | −.1082 | .0417 | −.5519 | −1.1748 |
| .1796 | −.1196 | .0383 | −.5380 | −1.1763 |
| .1999 | −.1303 | .0351 | −.5246 | −1.1774 |
| .2196 | −.1402 | .0322 | −.5117 | −1.1782 |
| .2452 | −.1525 | .0287 | −.4953 | −1.1790 |
| .2637 | −.1610 | .0263 | −.4836 | −1.1793 |
| .2877 | −.1716 | .0235 | −.4688 | −1.1795 |
| .3165 | −.1835 | .0203 | −.4517 | −1.1794 |
| .3440 | −.1942 | .0176 | −.4359 | −1.1791 |
| .3701 | −.2038 | .0152 | −.4216 | −1.1787 |
| .4046 | −.2156 | .0125 | −.4037 | −1.1780 |
| .4369 | −.2258 | .0103 | −.3884 | −1.1773 |
| .4792 | −.2378 | .0078 | −.3704 | −1.1762 |
| .5286 | −.2498 | .0055 | −.3533 | −1.1751 |
| .5947 | −.2623 | .0033 | −.3379 | −1.1739 |
| .7222 | −.2737 | .0011 | −.3362 | −1.1725 |
| 8.5140 | .0000 | .0000 | −3.9848 | −1.1718 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|:---:|:---:|:---:|
| $-9.1360$ | $-.7590$ | .4874 |
| $-8.8957$ | $-.7620$ | .5221 |
| $-8.6587$ | $-.7651$ | .5561 |
| $-8.4249$ | $-.7682$ | .5893 |
| $-8.1942$ | $-.7713$ | .6216 |
| $-7.8537$ | $-.7761$ | .6686 |
| $-7.6303$ | $-.7793$ | .6989 |
| $-7.3003$ | $-.7841$ | .7424 |
| $-7.0835$ | $-.7873$ | .7703 |
| $-6.7628$ | $-.7921$ | .8103 |
| $-6.4471$ | $-.7968$ | .8480 |
| $-6.1361$ | $-.8014$ | .8835 |
| $-5.8291$ | $-.8060$ | .9167 |
| $-5.4251$ | $-.8118$ | .9575 |
| $-5.1256$ | $-.8161$ | .9855 |
| $-4.7295$ | $-.8215$ | 1.0196 |
| $-4.2379$ | $-.8278$ | 1.0570 |
| $-3.7471$ | $-.8337$ | 1.0890 |
| $-3.2541$ | $-.8390$ | 1.1161 |
| $-2.5536$ | $-.8457$ | 1.1467 |
| $-1.8323$ | $-.8514$ | 1.1698 |
| $-.7451$ | $-.8580$ | 1.1924 |
| .8169 | $-.8645$ | 1.2081 |
| 3.7157 | $-.8710$ | 1.2135 |
| 14.9618 | $-.8775$ | 1.1914 |
| $+\infty$ | $-.8806$ | .9547 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-8.3884$ | $-.9537$ | .6890 | $-.1050$ |
| $-8.1960$ | $-.9379$ | .7054 | $-.1106$ |
| $-8.0078$ | $-.9225$ | .7204 | $-.1152$ |
| $-7.8238$ | $-.9075$ | .7341 | $-.1189$ |
| $-7.6437$ | $-.8928$ | .7464 | $-.1218$ |
| $-7.3809$ | $-.8714$ | .7628 | $-.1246$ |
| $-7.2104$ | $-.8577$ | .7724 | $-.1257$ |
| $-6.9617$ | $-.8377$ | .7848 | $-.1261$ |
| $-6.8004$ | $-.8248$ | .7920 | $-.1258$ |
| $-6.5650$ | $-.8062$ | .8012 | $-.1245$ |
| $-6.3373$ | $-.7883$ | .8087 | $-.1224$ |
| $-6.1170$ | $-.7713$ | .8146 | $-.1196$ |
| $-5.9041$ | $-.7551$ | .8193 | $-.1162$ |
| $-5.6311$ | $-.7347$ | .8237 | $-.1110$ |
| $-5.4343$ | $-.7204$ | .8258 | $-.1068$ |
| $-5.1821$ | $-.7024$ | .8275 | $-.1009$ |
| $-4.8829$ | $-.6819$ | .8278 | $-.0932$ |
| $-4.6005$ | $-.6633$ | .8269 | $-.0855$ |
| $-4.3344$ | $-.6467$ | .8249 | $-.0779$ |
| $-3.9875$ | $-.6263$ | .8212 | $-.0678$ |
| $-3.6689$ | $-.6091$ | .8170 | $-.0586$ |
| $-3.2589$ | $-.5892$ | .8107 | $-.0470$ |
| $-2.7971$ | $-.5699$ | .8034 | $-.0349$ |
| $-2.2194$ | $-.5506$ | .7947 | $-.0219$ |
| $-1.2991$ | $-.5306$ | .7844 | $-.0073$ |
| .0000 | $-.5208$ | .7792 | .0000 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| $-.1286$ | .1310 | .3006 |
| $-.1484$ | .1301 | .2967 |
| $-.1670$ | .1293 | .2933 |
| $-.1845$ | .1287 | .2902 |
| $-.2011$ | .1281 | .2875 |
| $-.2242$ | .1274 | .2841 |
| $-.2387$ | .1271 | .2822 |
| $-.2592$ | .1266 | .2798 |
| $-.2722$ | .1264 | .2785 |
| $-.2907$ | .1262 | .2770 |
| $-.3083$ | .1260 | .2758 |
| $-.3253$ | .1260 | .2750 |
| $-.3416$ | .1260 | .2745 |
| $-.3630$ | .1260 | .2742 |
| $-.3788$ | .1261 | .2742 |
| $-.3999$ | .1263 | .2745 |
| $-.4269$ | .1265 | .2752 |
| $-.4551$ | .1268 | .2761 |
| $-.4851$ | .1271 | .2773 |
| $-.5313$ | .1275 | .2790 |
| $-.5838$ | .1278 | .2809 |
| $-.6728$ | .1283 | .2836 |
| $-.8202$ | .1288 | .2869 |
| $-1.1396$ | .1293 | .2915 |
| $-2.6145$ | .1298 | .2998 |
| $-\infty$ | .1300 | .3367 |

| $\rho_{23}^{*}$ | $u_{23}^{*}$ | $p_{23}^{*}$ |
|---|---|---|
| .0000 | .0843 | .3331 |
| −.0153 | .0833 | .3285 |
| −.0294 | .0825 | .3243 |
| −.0424 | .0817 | .3205 |
| −.0543 | .0810 | .3171 |
| −.0705 | .0801 | .3125 |
| −.0802 | .0796 | .3098 |
| −.0934 | .0789 | .3062 |
| −.1012 | .0786 | .3041 |
| −.1118 | .0781 | .3013 |
| −.1210 | .0777 | .2988 |
| −.1291 | .0774 | .2967 |
| −.1361 | .0771 | .2949 |
| −.1439 | .0768 | .2929 |
| −.1487 | .0767 | .2916 |
| −.1540 | .0765 | .2901 |
| −.1590 | .0764 | .2887 |
| −.1624 | .0764 | .2875 |
| −.1645 | .0763 | .2866 |
| −.1657 | .0763 | .2857 |
| −.1653 | .0764 | .2850 |
| −.1625 | .0765 | .2844 |
| −.1566 | .0766 | .2838 |
| −.1448 | .0767 | .2834 |
| −.1151 | .0768 | .2829 |
| .0000 | .0769 | .2827 |

**Ecoulement d'ordre 2
effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.1480$ | .1551 | .1308 | .3334 |
| $-.1437$ | .1595 | .1279 | .3440 |
| $-.1404$ | .1638 | .1250 | .3538 |
| $-.1381$ | .1678 | .1224 | .3630 |
| $-.1366$ | .1716 | .1198 | .3714 |
| $-.1362$ | .1771 | .1163 | .3830 |
| $-.1369$ | .1805 | .1140 | .3900 |
| $-.1397$ | .1853 | .1109 | .3997 |
| $-.1426$ | .1884 | .1090 | .4055 |
| $-.1486$ | .1927 | .1064 | .4135 |
| $-.1564$ | .1967 | .1039 | .4206 |
| $-.1661$ | .2005 | .1017 | .4271 |
| $-.1778$ | .2040 | .0998 | .4329 |
| $-.1964$ | .2083 | .0974 | .4397 |
| $-.2127$ | .2113 | .0959 | .4442 |
| $-.2377$ | .2149 | .0942 | .4497 |
| $-.2744$ | .2190 | .0924 | .4556 |
| $-.3177$ | .2226 | .0910 | .4607 |
| $-.3679$ | .2258 | .0900 | .4652 |
| $-.4510$ | .2296 | .0890 | .4706 |
| $-.5507$ | .2328 | .0885 | .4754 |
| $-.7255$ | .2364 | .0885 | .4812 |
| $-1.0199$ | .2398 | .0893 | .4877 |
| $-1.6577$ | .2431 | .0915 | .4961 |
| $-4.5484$ | .2465 | .0980 | .5113 |
| $-\infty$ | .2481 | $-1.5300$ | .5817 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1034 | .1508 | .3710 |
| .0134 | .1065 | .1456 | .3818 |
| .0259 | .1094 | .1405 | .3915 |
| .0376 | .1121 | .1358 | .4004 |
| .0485 | .1146 | .1313 | .4085 |
| .0636 | .1179 | .1249 | .4192 |
| .0729 | .1200 | .1209 | .4256 |
| .0857 | .1227 | .1154 | .4341 |
| .0935 | .1244 | .1119 | .4391 |
| .1044 | .1267 | .1071 | .4457 |
| .1142 | .1287 | .1026 | .4515 |
| .1230 | .1305 | .0984 | .4565 |
| .1310 | .1321 | .0946 | .4609 |
| .1404 | .1340 | .0899 | .4657 |
| .1467 | .1352 | .0868 | .4688 |
| .1540 | .1367 | .0829 | .4723 |
| .1618 | .1382 | .0786 | .4758 |
| .1682 | .1395 | .0749 | .4785 |
| .1735 | .1406 | .0716 | .4806 |
| .1792 | .1418 | .0676 | .4829 |
| .1833 | .1427 | .0643 | .4844 |
| .1870 | .1437 | .0603 | .4860 |
| .1890 | .1447 | .0563 | .4871 |
| .1882 | .1455 | .0516 | .4880 |
| .1782 | .1463 | .0439 | .4886 |
| .0000 | .1468 | −.0504 | .4888 |

# tableaux 16

## $\alpha = 1.4$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9959 | .9924 | 1.0027 | .9982 |
| .9918 | .9847 | 1.0052 | .9964 |
| .9861 | .9733 | 1.0090 | .9937 |
| .9824 | .9657 | 1.0115 | .9919 |
| .9771 | .9544 | 1.0150 | .9892 |
| .9720 | .9431 | 1.0185 | .9866 |
| .9673 | .9319 | 1.0218 | .9840 |
| .9627 | .9207 | 1.0250 | .9814 |
| .9585 | .9097 | 1.0280 | .9789 |
| .9544 | .8987 | 1.0310 | .9765 |
| .9506 | .8878 | 1.0337 | .9741 |
| .9458 | .8735 | 1.0373 | .9711 |
| .9414 | .8593 | 1.0406 | .9683 |
| .9374 | .8453 | 1.0437 | .9656 |
| .9337 | .8316 | 1.0466 | .9631 |
| .9294 | .8147 | 1.0499 | .9602 |
| .9257 | .7982 | 1.0529 | .9576 |
| .9217 | .7789 | 1.0561 | .9547 |
| .9177 | .7571 | 1.0594 | .9519 |
| .9139 | .7331 | 1.0626 | .9492 |
| .9102 | .7046 | 1.0657 | .9465 |
| .9063 | .6674 | 1.0691 | .9438 |
| .9028 | .6195 | 1.0721 | .9413 |
| .8992 | .5262 | 1.0753 | .9390 |
| .8974 | .0394 | 1.0769 | .9381 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0068 | 1.0065 | $-.1901$ |
| 1.0135 | 1.0129 | $-.1807$ |
| 1.0233 | 1.0220 | $-.1672$ |
| 1.0296 | 1.0278 | $-.1588$ |
| 1.0389 | 1.0362 | $-.1468$ |
| 1.0478 | 1.0442 | $-.1357$ |
| 1.0564 | 1.0517 | $-.1252$ |
| 1.0646 | 1.0588 | $-.1155$ |
| 1.0726 | 1.0656 | $-.1065$ |
| 1.0802 | 1.0720 | $-.0981$ |
| 1.0875 | 1.0781 | $-.0903$ |
| 1.0967 | 1.0856 | $-.0807$ |
| 1.1053 | 1.0925 | $-.0721$ |
| 1.1134 | 1.0989 | $-.0643$ |
| 1.1210 | 1.1048 | $-.0573$ |
| 1.1296 | 1.1115 | $-.0495$ |
| 1.1375 | 1.1175 | $-.0428$ |
| 1.1459 | 1.1239 | $-.0358$ |
| 1.1544 | 1.1302 | $-.0291$ |
| 1.1626 | 1.1363 | $-.0229$ |
| 1.1709 | 1.1425 | $-.0170$ |
| 1.1795 | 1.1489 | $-.0112$ |
| 1.1875 | 1.1549 | $-.0063$ |
| 1.1959 | 1.1613 | $-.0018$ |
| 1.2000 | 1.1648 | $.0000$ |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0296 | .0823 | −.6872 | −1.1496 | .1093 |
| .0179 | .0784 | −.6804 | −1.1644 | .1049 |
| .0067 | .0748 | −.6737 | −1.1786 | .1006 |
| −.0092 | .0696 | −.6635 | −1.1988 | .0945 |
| −.0192 | .0664 | −.6567 | −1.2116 | .0905 |
| −.0335 | .0617 | −.6465 | −1.2298 | .0848 |
| −.0470 | .0574 | −.6364 | −1.2469 | .0793 |
| −.0597 | .0533 | −.6263 | −1.2630 | .0741 |
| −.0716 | .0495 | −.6163 | −1.2781 | .0692 |
| −.0830 | .0460 | −.6064 | −1.2923 | .0645 |
| −.0936 | .0426 | −.5966 | −1.3056 | .0601 |
| −.1038 | .0395 | −.5869 | −1.3181 | .0559 |
| −.1164 | .0357 | −.5743 | −1.3336 | .0508 |
| −.1282 | .0322 | −.5621 | −1.3477 | .0460 |
| −.1392 | .0290 | −.5502 | −1.3606 | .0416 |
| −.1494 | .0262 | −.5389 | −1.3724 | .0376 |
| −.1611 | .0229 | −.5253 | −1.3856 | .0331 |
| −.1719 | .0201 | −.5125 | −1.3973 | .0291 |
| −.1836 | .0171 | −.4984 | −1.4096 | .0248 |
| −.1958 | .0142 | −.4835 | −1.4218 | .0206 |
| −.2079 | .0115 | −.4687 | −1.4333 | .0167 |
| −.2207 | .0089 | −.4535 | −1.4446 | .0128 |
| −.2350 | .0062 | −.4381 | −1.4562 | .0088 |
| −.2495 | .0038 | −.4264 | −1.4666 | .0052 |
| −.2660 | .0013 | −.4326 | −1.4773 | .0016 |
| .0000 | .0000 | −5.0085 | −1.4824 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0926 | −.6872 | −1.1565 |
| .0144 | −.0114 | .0882 | −.6776 | −1.1616 |
| .0287 | −.0223 | .0840 | −.6682 | −1.1663 |
| .0499 | −.0377 | .0780 | −.6543 | −1.1724 |
| .0639 | −.0474 | .0742 | −.6451 | −1.1759 |
| .0847 | −.0612 | .0689 | −.6317 | −1.1806 |
| .1052 | −.0742 | .0640 | −.6186 | −1.1845 |
| .1254 | −.0864 | .0593 | −.6058 | −1.1879 |
| .1453 | −.0978 | .0550 | −.5933 | −1.1906 |
| .1650 | −.1086 | .0510 | −.5812 | −1.1929 |
| .1843 | −.1188 | .0473 | −.5694 | −1.1948 |
| .2034 | −.1284 | .0438 | −.5579 | −1.1963 |
| .2283 | −.1404 | .0395 | −.5432 | −1.1979 |
| .2527 | −.1515 | .0356 | −.5292 | −1.1990 |
| .2765 | −.1618 | .0321 | −.5158 | −1.1998 |
| .2997 | −.1714 | .0289 | −.5031 | −1.2002 |
| .3279 | −.1824 | .0254 | −.4882 | −1.2005 |
| .3552 | −.1925 | .0222 | −.4744 | −1.2005 |
| .3868 | −.2034 | .0189 | −.4593 | −1.2003 |
| .4220 | −.2148 | .0157 | −.4437 | −1.1998 |
| .4601 | −.2260 | .0127 | −.4284 | −1.1991 |
| .5047 | −.2378 | .0098 | −.4128 | −1.1983 |
| .5621 | −.2509 | .0068 | −.3971 | −1.1972 |
| .6352 | −.2640 | .0042 | −.3850 | −1.1960 |
| .7825 | −.2781 | .0014 | −.3890 | −1.1946 |
| 9.7570 | .0000 | .0000 | −4.4948 | −1.1939 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|-------------|----------|----------|
| $-7.5022$ | $-.7457$ | .5350 |
| $-7.3368$ | $-.7493$ | .5590 |
| $-7.1725$ | $-.7529$ | .5829 |
| $-6.9283$ | $-.7583$ | .6185 |
| $-6.7670$ | $-.7619$ | .6420 |
| $-6.5272$ | $-.7672$ | .6767 |
| $-6.2899$ | $-.7725$ | .7106 |
| $-6.0551$ | $-.7778$ | .7437 |
| $-5.8226$ | $-.7830$ | .7757 |
| $-5.5924$ | $-.7882$ | .8067 |
| $-5.3641$ | $-.7932$ | .8365 |
| $-5.1376$ | $-.7982$ | .8651 |
| $-4.8381$ | $-.8046$ | .9012 |
| $-4.5408$ | $-.8108$ | .9348 |
| $-4.2451$ | $-.8168$ | .9660 |
| $-3.9502$ | $-.8225$ | .9947 |
| $-3.5814$ | $-.8293$ | 1.0271 |
| $-3.2108$ | $-.8355$ | 1.0557 |
| $-2.7609$ | $-.8424$ | 1.0852 |
| $-2.2239$ | $-.8496$ | 1.1136 |
| $-1.5863$ | $-.8566$ | 1.1388 |
| $-.7370$ | $-.8638$ | 1.1613 |
| .5935 | $-.8715$ | 1.1796 |
| 2.9199 | $-.8786$ | 1.1885 |
| 12.1042 | $-.8861$ | 1.1748 |
| $+\infty$ | $-.8897$ | .9671 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-6.9204$ | $-.9501$ | .6702 | $-.1283$ |
| $-6.7844$ | $-.9362$ | .6839 | $-.1318$ |
| $-6.6506$ | $-.9225$ | .6965 | $-.1346$ |
| $-6.4540$ | $-.9025$ | .7137 | $-.1376$ |
| $-6.3255$ | $-.8895$ | .7241 | $-.1389$ |
| $-6.1367$ | $-.8705$ | .7381 | $-.1398$ |
| $-5.9525$ | $-.8521$ | .7504 | $-.1397$ |
| $-5.7728$ | $-.8342$ | .7611 | $-.1387$ |
| $-5.5976$ | $-.8170$ | .7703 | $-.1369$ |
| $-5.4267$ | $-.8003$ | .7781 | $-.1344$ |
| $-5.2601$ | $-.7843$ | .7847 | $-.1314$ |
| $-5.0978$ | $-.7688$ | .7902 | $-.1279$ |
| $-4.8878$ | $-.7491$ | .7960 | $-.1228$ |
| $-4.6851$ | $-.7305$ | .8001 | $-.1171$ |
| $-4.4894$ | $-.7129$ | .8030 | $-.1111$ |
| $-4.3008$ | $-.6965$ | .8047 | $-.1049$ |
| $-4.0745$ | $-.6774$ | .8055 | $-.0970$ |
| $-3.8587$ | $-.6599$ | .8052 | $-.0892$ |
| $-3.6132$ | $-.6410$ | .8037 | $-.0800$ |
| $-3.3447$ | $-.6216$ | .8010 | $-.0700$ |
| $-3.0605$ | $-.6027$ | .7972 | $-.0595$ |
| $-2.7377$ | $-.5835$ | .7922 | $-.0481$ |
| $-2.3416$ | $-.5633$ | .7857 | $-.0352$ |
| $-1.8748$ | $-.5443$ | .7783 | $-.0223$ |
| $-1.1104$ | $-.5242$ | .7694 | $-.0076$ |
| .0000 | $-.5142$ | .7647 | .0000 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| $-.1011$ | .1407 | .3263 |
| $-.1183$ | .1398 | .3229 |
| $-.1345$ | .1389 | .3199 |
| $-.1573$ | .1378 | .3159 |
| $-.1715$ | .1372 | .3136 |
| $-.1916$ | .1364 | .3106 |
| $-.2104$ | .1357 | .3081 |
| $-.2281$ | .1353 | .3060 |
| $-.2447$ | .1349 | .3044 |
| $-.2605$ | .1346 | .3031 |
| $-.2755$ | .1344 | .3021 |
| $-.2900$ | .1343 | .3013 |
| $-.3086$ | .1343 | .3007 |
| $-.3267$ | .1343 | .3005 |
| $-.3444$ | .1344 | .3005 |
| $-.3622$ | .1345 | .3008 |
| $-.3847$ | .1348 | .3014 |
| $-.4080$ | .1350 | .3023 |
| $-.4377$ | .1354 | .3035 |
| $-.4757$ | .1358 | .3051 |
| $-.5252$ | .1362 | .3070 |
| $-.5989$ | .1367 | .3095 |
| $-.7315$ | .1373 | .3128 |
| $-1.0017$ | .1378 | .3170 |
| $-2.2697$ | .1384 | .3246 |
| $-\infty$ | .1386 | .3592 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .0887 | .3447 |
| −.0133 | .0877 | .3406 |
| −.0257 | .0868 | .3369 |
| −.0427 | .0856 | .3319 |
| −.0532 | .0849 | .3289 |
| −.0675 | .0839 | .3247 |
| −.0805 | .0831 | .3211 |
| −.0921 | .0825 | .3178 |
| −.1025 | .0819 | .3149 |
| −.1119 | .0814 | .3123 |
| −.1202 | .0810 | .3101 |
| −.1277 | .0807 | .3080 |
| −.1363 | .0803 | .3057 |
| −.1436 | .0800 | .3037 |
| −.1496 | .0798 | .3020 |
| −.1546 | .0797 | .3006 |
| −.1596 | .0796 | .2990 |
| −.1632 | .0795 | .2978 |
| −.1661 | .0795 | .2966 |
| −.1678 | .0795 | .2956 |
| −.1680 | .0795 | .2946 |
| −.1661 | .0796 | .2938 |
| −.1610 | .0798 | .2931 |
| −.1506 | .0799 | .2925 |
| −.1229 | .0801 | .2919 |
| .0000 | .0801 | .2915 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.1057$ | .1552 | .1290 | .3506 |
| $-.1014$ | .1597 | .1270 | .3612 |
| $-.0978$ | .1641 | .1250 | .3711 |
| $-.0936$ | .1703 | .1222 | .3850 |
| $-.0917$ | .1743 | .1205 | .3936 |
| $-.0899$ | .1799 | .1181 | .4055 |
| $-.0896$ | .1853 | .1159 | .4164 |
| $-.0907$ | .1904 | .1139 | .4263 |
| $-.0931$ | .1952 | .1120 | .4354 |
| $-.0969$ | .1997 | .1104 | .4437 |
| $-.1022$ | .2040 | .1089 | .4513 |
| $-.1088$ | .2080 | .1076 | .4582 |
| $-.1199$ | .2131 | .1061 | .4665 |
| $-.1336$ | .2178 | .1049 | .4739 |
| $-.1500$ | .2221 | .1038 | .4804 |
| $-.1693$ | .2261 | .1031 | .4863 |
| $-.1978$ | .2307 | .1023 | .4927 |
| $-.2313$ | .2348 | .1019 | .4983 |
| $-.2788$ | .2392 | .1017 | .5042 |
| $-.3454$ | .2435 | .1019 | .5101 |
| $-.4379$ | .2477 | .1025 | .5159 |
| $-.5822$ | .2520 | .1037 | .5220 |
| $-.8480$ | .2563 | .1060 | .5291 |
| $-1.3917$ | .2604 | .1097 | .5373 |
| $-3.9004$ | .2646 | .1180 | .5517 |
| $-\infty$ | .2667 | $-2.4868$ | .6183 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1015 | .1477 | .3700 |
| .0116 | .1048 | .1436 | .3805 |
| .0225 | .1079 | .1397 | .3901 |
| .0379 | .1121 | .1343 | .4031 |
| .0474 | .1147 | .1308 | .4110 |
| .0608 | .1183 | .1259 | .4216 |
| .0731 | .1215 | .1213 | .4311 |
| .0845 | .1244 | .1171 | .4394 |
| .0949 | .1271 | .1131 | .4468 |
| .1045 | .1295 | .1094 | .4534 |
| .1133 | .1316 | .1060 | .4591 |
| .1214 | .1336 | .1027 | .4643 |
| .1312 | .1360 | .0988 | .4702 |
| .1399 | .1380 | .0952 | .4752 |
| .1477 | .1399 | .0920 | .4794 |
| .1545 | .1415 | .0890 | .4829 |
| .1620 | .1432 | .0856 | .4866 |
| .1683 | .1447 | .0827 | .4896 |
| .1746 | .1462 | .0795 | .4924 |
| .1805 | .1476 | .0763 | .4949 |
| .1855 | .1489 | .0732 | .4969 |
| .1896 | .1502 | .0699 | .4986 |
| .1926 | .1514 | .0662 | .5001 |
| .1929 | .1524 | .0620 | .5011 |
| .1847 | .1536 | .0540 | .5019 |
| .0000 | .1541 | $-.0879$ | .5022 |

# tableaux 17

## $\alpha = 1.4$ et $\gamma = 1.67$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|---|---|---|---|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9938 | .9947 | 1.0045 | 1.0000 |
| .9858 | .9875 | 1.0103 | .9999 |
| .9781 | .9801 | 1.0160 | .9994 |
| .9708 | .9725 | 1.0215 | .9988 |
| .9637 | .9648 | 1.0269 | .9980 |
| .9553 | .9551 | 1.0334 | .9968 |
| .9489 | .9471 | 1.0384 | .9957 |
| .9427 | .9391 | 1.0432 | .9945 |
| .9354 | .9289 | 1.0491 | .9929 |
| .9286 | .9186 | 1.0548 | .9912 |
| .9221 | .9082 | 1.0602 | .9894 |
| .9159 | .8977 | 1.0653 | .9876 |
| .9102 | .8871 | 1.0703 | .9857 |
| .9038 | .8743 | 1.0759 | .9835 |
| .8978 | .8614 | 1.0811 | .9812 |
| .8924 | .8484 | 1.0860 | .9791 |
| .8866 | .8333 | 1.0913 | .9767 |
| .8807 | .8160 | 1.0968 | .9741 |
| .8750 | .7966 | 1.1023 | .9715 |
| .8701 | .7774 | 1.1070 | .9692 |
| .8647 | .7521 | 1.1122 | .9665 |
| .8593 | .7194 | 1.1176 | .9638 |
| .8542 | .6748 | 1.1228 | .9613 |
| .8493 | .5920 | 1.1279 | .9589 |
| .8468 | .0535 | 1.1305 | .9579 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | $-.3350$ |
| 1.0108 | 1.0126 | $-.3185$ |
| 1.0249 | 1.0289 | $-.2976$ |
| 1.0387 | 1.0446 | $-.2778$ |
| 1.0523 | 1.0599 | $-.2591$ |
| 1.0656 | 1.0746 | $-.2414$ |
| 1.0817 | 1.0923 | $-.2207$ |
| 1.0943 | 1.1059 | $-.2052$ |
| 1.1066 | 1.1190 | $-.1906$ |
| 1.1215 | 1.1347 | $-.1735$ |
| 1.1359 | 1.1496 | $-.1577$ |
| 1.1498 | 1.1638 | $-.1430$ |
| 1.1631 | 1.1772 | $-.1295$ |
| 1.1759 | 1.1898 | $-.1169$ |
| 1.1904 | 1.2041 | $-.1032$ |
| 1.2041 | 1.2173 | $-.0909$ |
| 1.2170 | 1.2295 | $-.0797$ |
| 1.2309 | 1.2425 | $-.0682$ |
| 1.2453 | 1.2558 | $-.0568$ |
| 1.2597 | 1.2689 | $-.0459$ |
| 1.2723 | 1.2802 | $-.0369$ |
| 1.2862 | 1.2926 | $-.0274$ |
| 1.3006 | 1.3052 | $-.0183$ |
| 1.3144 | 1.3173 | $-.0101$ |
| 1.3280 | 1.3294 | $-.0030$ |
| 1.3350 | 1.3357 | $.0000$ |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0203 | .1434 | −.7804 | −1.1904 | .1907 |
| .0097 | .1376 | −.7780 | −1.2138 | .1831 |
| −.0038 | .1302 | −.7748 | −1.2440 | .1733 |
| −.0166 | .1231 | −.7713 | −1.2730 | .1639 |
| −.0287 | .1163 | −.7676 | −1.3009 | .1547 |
| −.0404 | .1098 | −.7638 | −1.3277 | .1459 |
| −.0542 | .1021 | −.7588 | −1.3597 | .1353 |
| −.0647 | .0962 | −.7546 | −1.3842 | .1272 |
| −.0748 | .0905 | −.7503 | −1.4077 | .1195 |
| −.0868 | .0838 | −.7447 | −1.4357 | .1102 |
| −.0983 | .0774 | −.7390 | −1.4622 | .1015 |
| −.1092 | .0714 | −.7332 | −1.4873 | .0933 |
| −.1196 | .0658 | −.7273 | −1.5110 | .0855 |
| −.1295 | .0604 | −.7214 | −1.5333 | .0782 |
| −.1409 | .0544 | −.7143 | −1.5583 | .0701 |
| −.1516 | .0489 | −.7073 | −1.5814 | .0627 |
| −.1617 | .0438 | −.7004 | −1.6026 | .0558 |
| −.1729 | .0384 | −.6926 | −1.6252 | .0486 |
| −.1848 | .0328 | −.6843 | −1.6481 | .0413 |
| −.1971 | .0274 | −.6759 | −1.6706 | .0341 |
| −.2084 | .0228 | −.6686 | −1.6898 | .0281 |
| −.2218 | .0177 | −.6610 | −1.7108 | .0215 |
| −.2372 | .0125 | −.6550 | −1.7319 | .0149 |
| −.2546 | .0076 | −.6550 | −1.7518 | .0088 |
| −.2772 | .0027 | −.6837 | −1.7709 | .0029 |
| .0000 | .0000 | −6.8889 | −1.7806 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1610 | $-.7804$ | $-1.1899$ |
| .0147 | $-.0108$ | .1538 | $-.7732$ | $-1.1989$ |
| .0343 | $-.0244$ | .1446 | $-.7638$ | $-1.2097$ |
| .0540 | $-.0374$ | .1360 | $-.7544$ | $-1.2193$ |
| .0737 | $-.0496$ | .1278 | $-.7452$ | $-1.2278$ |
| .0934 | $-.0612$ | .1200 | $-.7361$ | $-1.2354$ |
| .1181 | $-.0750$ | .1109 | $-.7249$ | $-1.2436$ |
| .1379 | $-.0854$ | .1040 | $-.7160$ | $-1.2493$ |
| .1578 | $-.0954$ | .0975 | $-.7073$ | $-1.2543$ |
| .1827 | $-.1072$ | .0898 | $-.6967$ | $-1.2597$ |
| .2076 | $-.1184$ | .0826 | $-.6862$ | $-1.2642$ |
| .2327 | $-.1291$ | .0759 | $-.6761$ | $-1.2680$ |
| .2577 | $-.1392$ | .0696 | $-.6662$ | $-1.2711$ |
| .2829 | $-.1488$ | .0637 | $-.6566$ | $-1.2736$ |
| .3131 | $-.1597$ | .0572 | $-.6456$ | $-1.2760$ |
| .3434 | $-.1700$ | .0512 | $-.6350$ | $-1.2779$ |
| .3738 | $-.1797$ | .0457 | $-.6250$ | $-1.2792$ |
| .4091 | $-.1904$ | .0399 | $-.6141$ | $-1.2802$ |
| .4495 | $-.2017$ | .0340 | $-.6027$ | $-1.2808$ |
| .4947 | $-.2134$ | .0283 | $-.5914$ | $-1.2811$ |
| .5396 | $-.2241$ | .0234 | $-.5818$ | $-1.2810$ |
| .5987 | $-.2368$ | .0181 | $-.5716$ | $-1.2806$ |
| .6758 | $-.2513$ | .0128 | $-.5629$ | $-1.2799$ |
| .7824 | $-.2676$ | .0077 | $-.5595$ | $-1.2789$ |
| .9922 | $-.2884$ | .0027 | $-.5806$ | $-1.2776$ |
| 13.2850 | .0000 | .0000 | $-5.8337$ | $-1.2769$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|:---:|:---:|:---:|
| $-4.4053$ | $-.7011$ | .6193 |
| $-4.3263$ | $-.7080$ | .6308 |
| $-4.2198$ | $-.7170$ | .6473 |
| $-4.1120$ | $-.7257$ | .6650 |
| $-4.0031$ | $-.7342$ | .6836 |
| $-3.8932$ | $-.7424$ | .7030 |
| $-3.7546$ | $-.7525$ | .7281 |
| $-3.6429$ | $-.7604$ | .7487 |
| $-3.5304$ | $-.7681$ | .7697 |
| $-3.3888$ | $-.7775$ | .7960 |
| $-3.2459$ | $-.7867$ | .8225 |
| $-3.1018$ | $-.7957$ | .8488 |
| $-2.9562$ | $-.8044$ | .8747 |
| $-2.8091$ | $-.8128$ | .9001 |
| $-2.6301$ | $-.8226$ | .9295 |
| $-2.4479$ | $-.8319$ | .9577 |
| $-2.2620$ | $-.8408$ | .9844 |
| $-2.0392$ | $-.8505$ | 1.0134 |
| $-1.7751$ | $-.8608$ | 1.0433 |
| $-1.4624$ | $-.8713$ | 1.0728 |
| $-1.1287$ | $-.8805$ | 1.0978 |
| $-.6405$ | $-.8910$ | 1.1243 |
| .1162 | $-.9019$ | 1.1489 |
| 1.5197 | $-.9125$ | 1.1676 |
| 6.7902 | $-.9231$ | 1.1718 |
| $+\infty$ | $-.9284$ | 1.0205 |

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| $\rho^*_{22}$ | $u^*_{22}$ | $p^*_{22}$ | $\psi_{22}$ |
|---|---|---|---|
| $-4.1316$ | $-.9386$ | $.6133$ | $-.2206$ |
| $-4.0597$ | $-.9253$ | $.6250$ | $-.2180$ |
| $-3.9645$ | $-.9078$ | $.6396$ | $-.2141$ |
| $-3.8703$ | $-.8908$ | $.6530$ | $-.2096$ |
| $-3.7770$ | $-.8740$ | $.6652$ | $-.2047$ |
| $-3.6846$ | $-.8576$ | $.6763$ | $-.1994$ |
| $-3.5705$ | $-.8376$ | $.6887$ | $-.1923$ |
| $-3.4803$ | $-.8219$ | $.6976$ | $-.1863$ |
| $-3.3911$ | $-.8066$ | $.7055$ | $-.1801$ |
| $-3.2810$ | $-.7878$ | $.7142$ | $-.1721$ |
| $-3.1725$ | $-.7696$ | $.7216$ | $-.1639$ |
| $-3.0657$ | $-.7519$ | $.7279$ | $-.1556$ |
| $-2.9605$ | $-.7347$ | $.7330$ | $-.1472$ |
| $-2.8570$ | $-.7181$ | $.7372$ | $-.1389$ |
| $-2.7350$ | $-.6990$ | $.7410$ | $-.1289$ |
| $-2.6156$ | $-.6809$ | $.7436$ | $-.1191$ |
| $-2.4987$ | $-.6637$ | $.7453$ | $-.1095$ |
| $-2.3659$ | $-.6449$ | $.7461$ | $-.0987$ |
| $-2.2187$ | $-.6252$ | $.7460$ | $-.0871$ |
| $-2.0595$ | $-.6052$ | $.7447$ | $-.0750$ |
| $-1.9074$ | $-.5877$ | $.7428$ | $-.0640$ |
| $-1.7162$ | $-.5679$ | $.7396$ | $-.0512$ |
| $-1.4833$ | $-.5473$ | $.7353$ | $-.0373$ |
| $-1.1934$ | $-.5272$ | $.7300$ | $-.0231$ |
| $-.7370$ | $-.5071$ | $.7237$ | $-.0081$ |
| $.0000$ | $-.4967$ | $.7201$ | $.0000$ |

**Ecoulement d'ordre 2
effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| $-.0469$ | .1776 | .4060 |
| $-.0628$ | .1761 | .4036 |
| $-.0826$ | .1743 | .4008 |
| $-.1012$ | .1728 | .3984 |
| $-.1186$ | .1715 | .3964 |
| $-.1350$ | .1705 | .3948 |
| $-.1542$ | .1695 | .3931 |
| $-.1686$ | .1688 | .3922 |
| $-.1823$ | .1683 | .3914 |
| $-.1986$ | .1679 | .3908 |
| $-.2140$ | .1676 | .3905 |
| $-.2288$ | .1675 | .3904 |
| $-.2429$ | .1675 | .3906 |
| $-.2567$ | .1676 | .3909 |
| $-.2729$ | .1678 | .3916 |
| $-.2889$ | .1681 | .3925 |
| $-.3051$ | .1685 | .3935 |
| $-.3245$ | .1690 | .3949 |
| $-.3479$ | .1696 | .3966 |
| $-.3769$ | .1703 | .3986 |
| $-.4098$ | .1710 | .4006 |
| $-.4622$ | .1718 | .4033 |
| $-.5539$ | .1726 | .4067 |
| $-.7507$ | .1735 | .4109 |
| $-1.6255$ | .1744 | .4175 |
| $-\infty$ | .1748 | .4494 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .1048 | .3870 |
| −.0121 | .1034 | .3835 |
| −.0272 | .1018 | .3792 |
| −.0411 | .1003 | .3751 |
| −.0540 | .0990 | .3714 |
| −.0660 | .0979 | .3679 |
| −.0796 | .0967 | .3639 |
| −.0896 | .0958 | .3609 |
| −.0989 | .0951 | .3582 |
| −.1094 | .0944 | .3550 |
| −.1189 | .0938 | .3521 |
| −.1274 | .0933 | .3494 |
| −.1351 | .0929 | .3470 |
| −.1419 | .0926 | .3448 |
| −.1490 | .0924 | .3424 |
| −.1551 | .0922 | .3403 |
| −.1602 | .0922 | .3384 |
| −.1650 | .0921 | .3364 |
| −.1692 | .0922 | .3345 |
| −.1723 | .0923 | .3327 |
| −.1740 | .0924 | .3312 |
| −.1744 | .0926 | .3296 |
| −.1721 | .0929 | .3281 |
| −.1650 | .0931 | .3266 |
| −.1432 | .0934 | .3253 |
| .0000 | .0935 | .3245 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.0320$ | .1548 | .1227 | .3853 |
| $-.0269$ | .1614 | .1225 | .4002 |
| $-.0208$ | .1699 | .1223 | .4191 |
| $-.0156$ | .1781 | .1223 | .4371 |
| $-.0113$ | .1860 | .1224 | .4541 |
| $-.0078$ | .1937 | .1227 | .4702 |
| $-.0046$ | .2029 | .1233 | .4891 |
| $-.0030$ | .2100 | .1239 | .5032 |
| $-.0023$ | .2169 | .1246 | .5166 |
| $-.0026$ | .2251 | .1257 | .5322 |
| $-.0043$ | .2330 | .1269 | .5467 |
| $-.0074$ | .2406 | .1283 | .5601 |
| $-.0121$ | .2479 | .1299 | .5725 |
| $-.0185$ | .2548 | .1316 | .5839 |
| $-.0283$ | .2626 | .1338 | .5964 |
| $-.0410$ | .2700 | .1362 | .6077 |
| $-.0566$ | .2769 | .1387 | .6179 |
| $-.0790$ | .2844 | .1418 | .6285 |
| $-.1110$ | .2922 | .1455 | .6391 |
| $-.1563$ | .2999 | .1497 | .6493 |
| $-.2134$ | .3067 | .1540 | .6580 |
| $-.3117$ | .3143 | .1597 | .6677 |
| $-.4930$ | .3221 | .1670 | .6779 |
| $-.8915$ | .3298 | .1764 | .6888 |
| $-2.6520$ | .3374 | .1901 | .7038 |
| $-\infty$ | .3413 | $-6.0077$ | .7674 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .0949 | .1366 | .3665 |
| .0104 | .0999 | .1346 | .3800 |
| .0237 | .1060 | .1322 | .3966 |
| .0361 | .1117 | .1299 | .4116 |
| .0479 | .1169 | .1278 | .4253 |
| .0590 | .1218 | .1258 | .4377 |
| .0720 | .1273 | .1236 | .4517 |
| .0817 | .1314 | .1220 | .4618 |
| .0909 | .1352 | .1205 | .4709 |
| .1016 | .1395 | .1188 | .4812 |
| .1116 | .1435 | .1173 | .4903 |
| .1209 | .1471 | .1160 | .4984 |
| .1295 | .1504 | .1148 | .5056 |
| .1374 | .1534 | .1137 | .5119 |
| .1461 | .1567 | .1125 | .5185 |
| .1541 | .1596 | .1115 | .5241 |
| .1612 | .1623 | .1106 | .5289 |
| .1686 | .1650 | .1096 | .5336 |
| .1759 | .1677 | .1087 | .5380 |
| .1829 | .1703 | .1077 | .5419 |
| .1886 | .1724 | .1067 | .5449 |
| .1944 | .1748 | .1055 | .5478 |
| .1996 | .1771 | .1037 | .5503 |
| .2029 | .1793 | .1007 | .5523 |
| .1997 | .1814 | .0925 | .5539 |
| .0000 | .1826 | $-.2724$ | .5546 |

# tableaux 18

## $\alpha = 1.6$ et $\gamma = 1.33$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9965 | .9958 | 1.0028 | 1.0000 |
| .9931 | .9915 | 1.0056 | .9999 |
| .9893 | .9863 | 1.0087 | .9997 |
| .9855 | .9810 | 1.0118 | .9993 |
| .9819 | .9754 | 1.0147 | .9989 |
| .9785 | .9698 | 1.0176 | .9983 |
| .9751 | .9610 | 1.0204 | .9977 |
| .9715 | .9573 | 1.0234 | .9968 |
| .9679 | .9504 | 1.0264 | .9959 |
| .9646 | .9434 | 1.0292 | .9950 |
| .9614 | .9363 | 1.0320 | .9940 |
| .9580 | .9282 | 1.0349 | .9928 |
| .9545 | .9190 | 1.0380 | .9915 |
| .9515 | .9107 | 1.0406 | .9903 |
| .9481 | .9004 | 1.0436 | .9888 |
| .9449 | .8900 | 1.0464 | .9874 |
| .9416 | .8776 | 1.0494 | .9858 |
| .9386 | .8652 | 1.0521 | .9843 |
| .9354 | .8499 | 1.0550 | .9826 |
| .9323 | .8327 | 1.0579 | .9809 |
| .9294 | .8129 | 1.0606 | .9792 |
| .9263 | .7861 | 1.0635 | .9774 |
| .9233 | .7489 | 1.0663 | .9757 |
| .9204 | .6766 | 1.0691 | .9740 |
| .9189 | .1353 | 1.0705 | .9732 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | −.1650 |
| 1.0063 | 1.0070 | −.1569 |
| 1.0126 | 1.0139 | −.1491 |
| 1.0197 | 1.0215 | −.1403 |
| 1.0266 | 1.0289 | −.1318 |
| 1.0334 | 1.0360 | −.1238 |
| 1.0400 | 1.0427 | −.1161 |
| 1.0464 | 1.0492 | −.1087 |
| 1.0535 | 1.0563 | −.1007 |
| 1.0604 | 1.0630 | −.0931 |
| 1.0670 | 1.0694 | −.0860 |
| 1.0734 | 1.0754 | −.0793 |
| 1.0803 | 1.0817 | −.0722 |
| 1.0875 | 1.0883 | −.0649 |
| 1.0937 | 1.0939 | −.0588 |
| 1.1007 | 1.1001 | −.0520 |
| 1.1073 | 1.1058 | −.0458 |
| 1.1144 | 1.1119 | −.0393 |
| 1.1209 | 1.1172 | −.0336 |
| 1.1279 | 1.1230 | −.0276 |
| 1.1347 | 1.1285 | −.0219 |
| 1.1412 | 1.1337 | −.0167 |
| 1.1482 | 1.1392 | −.0114 |
| 1.1549 | 1.1445 | −.0065 |
| 1.1616 | 1.1498 | −.0019 |
| 1.1650 | 1.1525 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0216 | .0531 | −.6457 | −1.1183 | .0903 |
| .0151 | .0503 | −.6380 | −1.1299 | .0861 |
| .0086 | .0477 | −.6303 | −1.1411 | .0821 |
| .0013 | .0448 | −.6211 | −1.1536 | .0775 |
| −.0057 | .0420 | −.6118 | −1.1657 | .0731 |
| −.0126 | .0394 | −.6025 | −1.1772 | .0689 |
| −.0194 | .0368 | −.5930 | −1.1883 | .0648 |
| .−.0259 | .0344 | −.5835 | −1.1988 | .0609 |
| −.0332 | .0318 | −.5726 | −1.2103 | .0567 |
| −.0403 | .0294 | −.5616 | −1.2212 | .0526 |
| −.0472 | .0270 | −.5506 | −1.2316 | .0488 |
| −.0538 | .0249 | −.5396 | −1.2413 | .0452 |
| −.0612 | .0226 | −.5272 | −1.2517 | .0413 |
| −.0690 | .0202 | −.5136 | −1.2624 | .0374 |
| −.0759 | .0183 | −.5015 | −1.2714 | .0340 |
| −.0840 | .0161 | −.4869 | −1.2815 | .0303 |
| −.0918 | .0142 | −.4727 | −1.2907 | .0269 |
| −.1006 | .0121 | −.4563 | −1.3005 | .0233 |
| −.1090 | .0104 | −.4406 | −1.3093 | .0200 |
| −.1188 | .0085 | −.4224 | −1.3186 | .0166 |
| −.1292 | .0067 | −.4034 | −1.3275 | .0134 |
| −.1403 | .0052 | −.3835 | −1.3359 | .0104 |
| −.1540 | .0035 | −.3602 | −1.3446 | .0072 |
| −.1709 | .0021 | −.3349 | −1.3529 | .0043 |
| −.1972 | .0007 | −.3079 | −1.3611 | .0014 |
| .0000 | .0000 | −1.2242 | −1.3652 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0681 | $-.6457$ | $-1.1179$ |
| .0139 | $-.0069$ | .0646 | $-.6358$ | $-1.1222$ |
| .0277 | $-.0136$ | .0613 | $-.6259$ | $-1.1261$ |
| .0439 | $-.0212$ | .0575 | $-.6144$ | $-1.1303$ |
| .0601 | $-.0285$ | .0540 | $-.6030$ | $-1.1339$ |
| .0763 | $-.0355$ | .0506 | $-.5916$ | $-1.1372$ |
| .0925 | $-.0423$ | .0474 | $-.5802$ | $-1.1401$ |
| .1087 | $-.0488$ | .0443 | $-.5690$ | $-1.1426$ |
| .1272 | $-.0561$ | .0410 | $-.5562$ | $-1.1451$ |
| .1456 | $-.0631$ | .0379 | $-.5436$ | $-1.1473$ |
| .1639 | $-.0698$ | .0350 | $-.5311$ | $-1.1491$ |
| .1822 | $-.0763$ | .0323 | $-.5187$ | $-1.1506$ |
| .2027 | $-.0834$ | .0294 | $-.5051$ | $-1.1520$ |
| .2252 | $-.0910$ | .0264 | $-.4902$ | $-1.1532$ |
| .2453 | $-.0976$ | .0240 | $-.4772$ | $-1.1540$ |
| .2697 | $-.1053$ | .0212 | $-.4616$ | $-1.1548$ |
| .2937 | $-.1127$ | .0187 | $-.4466$ | $-1.1553$ |
| .3216 | $-.1210$ | .0161 | $-.4297$ | $-1.1556$ |
| .3488 | $-.1290$ | .0138 | $-.4136$ | $-1.1558$ |
| .3815 | $-.1382$ | .0114 | $-.3951$ | $-1.1557$ |
| .4170 | $-.1479$ | .0091 | $-.3761$ | $-1.1555$ |
| .4564 | $-.1583$ | .0070 | $-.3564$ | $-1.1552$ |
| .5075 | $-.1712$ | .0049 | $-.3336$ | $-1.1547$ |
| .5744 | $-.1870$ | .0029 | $-.3092$ | $-1.1540$ |
| .6960 | $-.2115$ | .0010 | $-.2834$ | $-1.1532$ |
| 3.7778 | .0000 | .0000 | $-1.1250$ | $-1.1528$ |

**Ecoulement d'ordre 2
effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-7.7963$ | $-.6857$ | $.5141$ |
| $-7.6939$ | $-.6890$ | $.5265$ |
| $-7.5891$ | $-.6924$ | $.5396$ |
| $-7.4638$ | $-.6961$ | $.5558$ |
| $-7.3354$ | $-.6999$ | $.5727$ |
| $-7.2042$ | $-.7035$ | $.5902$ |
| $-7.0702$ | $-.7071$ | $.6082$ |
| $-6.9335$ | $-.7106$ | $.6265$ |
| $-6.7739$ | $-.7146$ | $.6477$ |
| $-6.6108$ | $-.7185$ | $.6691$ |
| $-6.4443$ | $-.7224$ | $.6904$ |
| $-6.2742$ | $-.7262$ | $.7116$ |
| $-6.0784$ | $-.7303$ | $.7350$ |
| $-5.8551$ | $-.7348$ | $.7603$ |
| $-5.6486$ | $-.7388$ | $.7824$ |
| $-5.3885$ | $-.7434$ | $.8081$ |
| $-5.1189$ | $-.7478$ | $.8323$ |
| $-4.7865$ | $-.7527$ | $.8588$ |
| $-4.4368$ | $-.7573$ | $.8827$ |
| $-3.9782$ | $-.7624$ | $.9086$ |
| $-3.4169$ | $-.7675$ | $.9330$ |
| $-2.6851$ | $-.7725$ | $.9555$ |
| $-1.4937$ | $-.7779$ | $.9773$ |
| $.7704$ | $-.7833$ | $.9944$ |
| $9.7061$ | $-.7888$ | $.9990$ |
| $+\infty$ | $-.7915$ | $.8467$ |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-7.4822$ | $-.9042$ | .5076 | $-.0892$ |
| $-7.3910$ | $-.8857$ | .5253 | $-.0901$ |
| $-7.2996$ | $-.8677$ | .5416 | $-.0907$ |
| $-7.1930$ | $-.8473$ | .5592 | $-.0910$ |
| $-7.0863$ | $-.8275$ | .5753 | $-.0910$ |
| $-6.9796$ | $-.8082$ | .5900 | $-.0906$ |
| $-6.8730$ | $-.7896$ | .6033 | $-.0899$ |
| $-6.7664$ | $-.7714$ | .6154 | $-.0889$ |
| $-6.6447$ | $-.7514$ | .6277 | $-.0874$ |
| $-6.5232$ | $-.7321$ | .6387 | $-.0856$ |
| $-6.4020$ | $-.7135$ | .6483 | $-.0835$ |
| $-6.2811$ | $-.6956$ | .6567 | $-.0812$ |
| $-6.1455$ | $-.6763$ | .6648 | $-.0784$ |
| $-5.9955$ | $-.6559$ | .6723 | $-.0750$ |
| $-5.8613$ | $-.6385$ | .6778 | $-.0717$ |
| $-5.6983$ | $-.6185$ | .6832 | $-.0676$ |
| $-5.5368$ | $-.5999$ | .6873 | $-.0633$ |
| $-5.3480$ | $-.5796$ | .6906 | $-.0582$ |
| $-5.1619$ | $-.5612$ | .6927 | $-.0532$ |
| $-4.9372$ | $-.5410$ | .6939 | $-.0471$ |
| $-4.6910$ | $-.5215$ | .6941 | $-.0406$ |
| $-4.4140$ | $-.5025$ | .6932 | $-.0338$ |
| $-4.0517$ | $-.4823$ | .6911 | $-.0257$ |
| $-3.5733$ | $-.4626$ | .6879 | $-.0168$ |
| $-2.7271$ | $-.4427$ | .6834 | $-.0063$ |
| .0000 | $-.4326$ | .6805 | .0000 |

## Ecoulement d'ordre 2
## effet isotrope du courant

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|:---:|:---:|:---:|
| $-.0534$ | .1296 | .3115 |
| $-.0695$ | .1285 | .3067 |
| $-.0851$ | .1276 | .3023 |
| $-.1026$ | .1266 | .2976 |
| $-.1194$ | .1258 | .2932 |
| $-.1357$ | .1251 | .2893 |
| $-.1515$ | .1244 | .2857 |
| $-.1669$ | .1239 | .2824 |
| $-.1839$ | .1234 | .2790 |
| $-.2005$ | .1230 | .2761 |
| $-.2168$ | .1227 | .2734 |
| $-.2329$ | .1225 | .2711 |
| $-.2507$ | .1223 | .2688 |
| $-.2705$ | .1222 | .2667 |
| $-.2884$ | .1222 | .2651 |
| $-.3106$ | .1222 | .2635 |
| $-.3336$ | .1223 | .2623 |
| $-.3619$ | .1224 | .2612 |
| $-.3923$ | .1226 | .2605 |
| $-.4335$ | .1229 | .2600 |
| $-.4864$ | .1232 | .2599 |
| $-.5601$ | .1235 | .2601 |
| $-.6912$ | .1239 | .2608 |
| $-.9698$ | .1243 | .2623 |
| $-2.2318$ | .1248 | .2658 |
| $-\infty$ | .1251 | .2918 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .0713 | .2990 |
| −.0115 | .0707 | .2954 |
| −.0225 | .0701 | .2920 |
| −.0347 | .0695 | .2884 |
| −.0463 | .0690 | .2851 |
| −.0573 | .0685 | .2820 |
| −.0676 | .0682 | .2791 |
| −.0775 | .0679 | .2765 |
| −.0880 | .0676 | .2738 |
| −.0979 | .0673 | .2714 |
| −.1072 | .0671 | .2691 |
| −.1158 | .0670 | .2671 |
| −.1248 | .0669 | .2651 |
| −.1341 | .0668 | .2632 |
| −.1417 | .0668 | .2616 |
| −.1501 | .0668 | .2600 |
| −.1576 | .0668 | .2586 |
| −.1655 | .0669 | .2573 |
| −.1722 | .0670 | .2562 |
| −.1791 | .0671 | .2551 |
| −.1853 | .0673 | .2543 |
| −.1905 | .0675 | .2535 |
| −.1948 | .0677 | .2529 |
| −.1965 | .0679 | .2524 |
| −.1894 | .0682 | .2520 |
| .0000 | .0683 | .2518 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.0691$ | .1674 | .1311 | .3652 |
| $-.0653$ | .1708 | .1286 | .3726 |
| $-.0620$ | .1742 | .1261 | .3795 |
| $-.0590$ | .1779 | .1233 | .3870 |
| $-.0569$ | .1816 | .1206 | .3940 |
| $-.0556$ | .1850 | .1181 | .4004 |
| $-.0551$ | .1883 | .1156 | .4064 |
| $-.0556$ | .1915 | .1133 | .4118 |
| $-.0572$ | .1950 | .1107 | .4175 |
| $-.0600$ | .1983 | .1084 | .4227 |
| $-.0642$ | .2015 | .1061 | .4273 |
| $-.0697$ | .2045 | .1041 | .4315 |
| $-.0777$ | .2077 | .1019 | .4357 |
| $-.0889$ | .2110 | .0997 | .4398 |
| $-.1013$ | .2138 | .0980 | .4431 |
| $-.1196$ | .2170 | .0961 | .4465 |
| $-.1419$ | .2200 | .0944 | .4495 |
| $-.1739$ | .2232 | .0928 | .4525 |
| $-.2131$ | .2260 | .0915 | .4550 |
| $-.2725$ | .2291 | .0904 | .4576 |
| $-.3571$ | .2320 | .0896 | .4600 |
| $-.4849$ | .2349 | .0893 | .4624 |
| $-.7268$ | .2379 | .0897 | .4652 |
| $-1.2641$ | .2407 | .0916 | .4687 |
| $-3.7501$ | .2436 | .0978 | .4754 |
| $-\infty$ | .2451 | .4357 | .5262 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .0982 | .1572 | .3523 |
| .0111 | .1007 | .1530 | .3609 |
| .0218 | .1031 | .1490 | .3689 |
| .0336 | .1057 | .1445 | .3774 |
| .0449 | .1081 | .1401 | .3851 |
| .0556 | .1103 | .1359 | .3922 |
| .0658 | .1123 | .1318 | .3986 |
| .0755 | .1142 | .1279 | .4045 |
| .0860 | .1161 | .1237 | .4105 |
| .0959 | .1179 | .1196 | .4159 |
| .1053 | .1195 | .1157 | .4207 |
| .1141 | .1210 | .1120 | .4249 |
| .1234 | .1224 | .1081 | .4292 |
| .1331 | .1239 | .1040 | .4332 |
| .1411 | .1250 | .1006 | .4364 |
| .1502 | .1263 | .0967 | .4397 |
| .1585 | .1274 | .0931 | .4424 |
| .1674 | .1284 | .0893 | .4451 |
| .1753 | .1294 | .0858 | .4472 |
| .1838 | .1303 | .0821 | .4492 |
| .1919 | .1311 | .0785 | .4509 |
| .1996 | .1318 | .0750 | .4523 |
| .2076 | .1325 | .0712 | .4534 |
| .2148 | .1331 | .0672 | .4543 |
| .2192 | .1336 | .0619 | .4549 |
| .0000 | .1339 | .0542 | .4550 |

# tableaux 19

## $\alpha = 1.6$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|---|---|---|---|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9959 | .9964 | 1.0034 | 1.0006 |
| .9913 | .9922 | 1.0073 | 1.0011 |
| .9869 | .9877 | 1.0110 | 1.0014 |
| .9826 | .9830 | 1.0146 | 1.0016 |
| .9784 | .9782 | 1.0181 | 1.0016 |
| .9744 | .9731 | 1.0215 | 1.0015 |
| .9700 | .9673 | 1.0253 | 1.0012 |
| .9663 | .9619 | 1.0285 | 1.0008 |
| .9618 | .9550 | 1.0324 | 1.0002 |
| .9579 | .9487 | 1.0358 | .9995 |
| .9538 | .9414 | 1.0394 | .9987 |
| .9500 | .9339 | 1.0428 | .9978 |
| .9463 | .9263 | 1.0461 | .9969 |
| .9422 | .9170 | 1.0498 | .9957 |
| .9386 | .9083 | 1.0530 | .9946 |
| .9348 | .8978 | 1.0566 | .9932 |
| .9310 | .8863 | 1.0601 | .9918 |
| .9273 | .8739 | 1.0635 | .9903 |
| .9239 | .8604 | 1.0668 | .9888 |
| .9202 | .8435 | 1.0703 | .9872 |
| .9167 | .8240 | 1.0737 | .9855 |
| .9132 | .7988 | 1.0771 | .9838 |
| .9097 | .7629 | 1.0805 | .9820 |
| .9063 | .6926 | 1.0839 | .9803 |
| .9047 | .1470 | 1.0856 | .9796 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0076 | 1.0089 | $-.1902$ |
| 1.0161 | 1.0187 | $-.1793$ |
| 1.0244 | 1.0283 | $-.1689$ |
| 1.0326 | 1.0374 | $-.1589$ |
| 1.0406 | 1.0463 | $-.1493$ |
| 1.0484 | 1.0548 | $-.1401$ |
| 1.0570 | 1.0640 | $-.1302$ |
| 1.0644 | 1.0719 | $-.1218$ |
| 1.0734 | 1.0812 | $-.1118$ |
| 1.0812 | 1.0893 | $-.1034$ |
| 1.0896 | 1.0977 | $-.0945$ |
| 1.0977 | 1.1057 | $-.0862$ |
| 1.1054 | 1.1133 | $-.0784$ |
| 1.1143 | 1.1217 | $-.0698$ |
| 1.1219 | 1.1289 | $-.0625$ |
| 1.1303 | 1.1367 | $-.0547$ |
| 1.1387 | 1.1443 | $-.0471$ |
| 1.1469 | 1.1516 | $-.0399$ |
| 1.1547 | 1.1585 | $-.0333$ |
| 1.1631 | 1.1659 | $-.0263$ |
| 1.1712 | 1.1728 | $-.0199$ |
| 1.1795 | 1.1797 | $-.0137$ |
| 1.1877 | 1.1866 | $-.0078$ |
| 1.1959 | 1.1934 | $-.0023$ |
| 1.2000 | 1.1969 | $.0000$ |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0182 | .0655 | −.6696 | −1.1318 | .1110 |
| .0118 | .0623 | −.6631 | −1.1457 | .1059 |
| .0047 | .0587 | −.6555 | −1.1611 | .1003 |
| −.0022 | .0553 | −.6477 | −1.1759 | .0948 |
| −.0089 | .0520 | −.6398 | −1.1902 | .0895 |
| −.0155 | .0489 | −.6317 | −1.2039 | .0844 |
| −.0219 | .0159 | −.6235 | −1.2171 | .0795 |
| −.0290 | .0427 | −.6141 | −1.2314 | .0742 |
| −.0352 | .0399 | −.6056 | −1.2436 | .0697 |
| −.0427 | .0367 | −.5919 | −1.2581 | .0643 |
| −.0492 | .0339 | −.5852 | −1.2705 | .0597 |
| −.0564 | .0310 | −.5742 | −1.2836 | .0548 |
| −.0633 | .0283 | −.5632 | −1.2959 | .0502 |
| −.0701 | .0258 | −.5522 | −1.3076 | .0459 |
| −.0781 | .0229 | −.5391 | −1.3207 | .0411 |
| −.0852 | .0206 | −.5270 | −1.3318 | .0371 |
| −.0933 | .0180 | −.5130 | −1.3439 | .0326 |
| −.1017 | .0155 | −.4983 | −1.3557 | .0283 |
| −.1104 | .0132 | −.4829 | −1.3670 | .0243 |
| −.1193 | .0110 | −.4673 | −1.3777 | .0204 |
| −.1298 | .0087 | −.4489 | −1.3890 | .0164 |
| −.1412 | .0067 | −.4299 | −1.3997 | .0126 |
| −.1546 | .0046 | −.4086 | −1.4104 | .0089 |
| −.1717 | .0027 | −.3852 | −1.4208 | .0052 |
| −.1990 | .0009 | −.3618 | −1.4311 | .0017 |
| .0000 | .0000 | −1.4050 | −1.4361 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0837 | −.6696 | −1.1282 |
| .0140 | −.0069 | .0795 | −.6604 | −1.1336 |
| .0300 | −.0146 | .0748 | −.6498 | −1.1392 |
| .0462 | −.0219 | .0704 | −.6392 | −1.1442 |
| .0624 | −.0290 | .0662 | −.6287 | −1.1487 |
| .0787 | −.0359 | .0622 | −.6181 | −1.1528 |
| .0950 | −.0425 | .0583 | −.6075 | −1.1564 |
| .1135 | −.0498 | .0542 | −.5957 | −1.1599 |
| .1299 | −.0560 | .0508 | −.5852 | −1.1627 |
| .1506 | −.0636 | .0467 | −.5722 | −1.1657 |
| .1692 | −.0701 | .0432 | −.5605 | −1.1681 |
| .1900 | −.0772 | .0395 | −.5477 | −1.1702 |
| .2108 | −.0841 | .0361 | −.5351 | −1.1720 |
| .2316 | −.0907 | .0329 | −.5226 | −1.1735 |
| .2565 | −.0984 | .0294 | −.5079 | −1.1749 |
| .2793 | −.1052 | .0264 | −.4947 | −1.1759 |
| .3062 | −.1130 | .0232 | −.4796 | −1.1767 |
| .3350 | −.1210 | .0201 | −.4639 | −1.1773 |
| .3655 | −.1293 | .0171 | −.4478 | −1.1777 |
| .3976 | −.1377 | .0144 | −.4317 | −1.1778 |
| .4370 | −.1477 | .0115 | −.4131 | −1.1778 |
| .4810 | −.1584 | .0088 | −.3941 | −1.1775 |
| .5359 | −.1711 | .0062 | −.3732 | −1.1771 |
| .6110 | −.1872 | .0036 | −.3504 | −1.1765 |
| .7513 | −.2128 | .0012 | −.3279 | −1.1757 |
| 4.3016 | .0000 | .0000 | −1.2710 | −1.1753 |

**Ecoulement d'ordre 2
effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|:---:|:---:|:---:|
| $-6.4011$ | $-.6714$ | .5390 |
| $-6.3241$ | $-.6757$ | .5478 |
| $-6.2328$ | $-.6804$ | .5590 |
| $-6.1383$ | $-.6850$ | .5714 |
| $-6.0406$ | $-.6895$ | .5847 |
| $-5.9400$ | $-.6939$ | .5988 |
| $-5.8365$ | $-.6983$ | .6136 |
| $-5.7168$ | $-.7030$ | .6309 |
| $-5.6074$ | $-.7072$ | .6468 |
| $-5.4668$ | $-.7123$ | .6671 |
| $-5.3365$ | $-.7168$ | .6857 |
| $-5.1876$ | $-.7217$ | .7064 |
| $-5.0342$ | $-.7265$ | .7271 |
| $-4.8760$ | $-.7311$ | .7476 |
| $-4.6796$ | $-.7366$ | .7717 |
| $-4.4925$ | $-.7414$ | .7931 |
| $-4.2621$ | $-.7468$ | .8173 |
| $-4.0012$ | $-.7523$ | .8417 |
| $-3.7045$ | $-.7578$ | .8657 |
| $-3.3651$ | $-.7632$ | .8887 |
| $-2.9005$ | $-.7692$ | .9135 |
| $-2.2960$ | $-.7751$ | .9364 |
| $-1.3567$ | $-.7812$ | .9583 |
| .4719 | $-.7874$ | .9768 |
| 7.7517 | $-.7937$ | .9850 |
| $+\infty$ | $-.7968$ | .8559 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −6.1728 | −.8997 | .4933 | −.1096 |
| −6.1001 | −.8813 | .5107 | −.1092 |
| −6.0165 | −.8608 | .5291 | −.1084 |
| −5.9327 | −.8410 | .5460 | −.1073 |
| −5.8484 | −.8216 | .5615 | −.1060 |
| −5.7639 | −.8028 | .5757 | −.1044 |
| −5.6790 | −.7845 | .5887 | −.1026 |
| −5.5833 | −.7645 | .6019 | −.1002 |
| −5.4979 | −.7473 | .6125 | −.0980 |
| −5.3909 | −.7264 | .6243 | −.0949 |
| −5.2943 | −.7082 | .6337 | −.0919 |
| −5.1869 | −.6887 | .6428 | −.0884 |
| −5.0793 | −.6700 | .6507 | −.0848 |
| −4.9715 | −.6521 | .6573 | −.0810 |
| −4.8423 | −.6316 | .6640 | −.0763 |
| −4.7239 | −.6138 | .6688 | −.0719 |
| −4.5843 | −.5941 | .6733 | −.0667 |
| −4.4346 | −.5744 | .6767 | −.0611 |
| −4.2753 | −.5551 | .6791 | −.0552 |
| −4.1072 | −.5366 | .6805 | −.0492 |
| −3.9003 | −.5164 | .6810 | −.0421 |
| −3.6686 | −.4970 | .6804 | −.0346 |
| −3.3787 | −.4771 | .6788 | −.0264 |
| −2.9849 | −.4572 | .6761 | −.0171 |
| −2.2843 | −.4371 | .6721 | −.0064 |
| .0000 | −.4270 | .6695 | .0000 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| $-.0364$ | .1391 | .3331 |
| $-.0522$ | .1378 | .3284 |
| $-.0695$ | .1365 | .3234 |
| $-.0861$ | .1353 | .3188 |
| $-.1022$ | .1343 | .3146 |
| $-.1177$ | .1335 | .3107 |
| $-.1328$ | .1327 | .3072 |
| $-.1492$ | .1320 | .3036 |
| $-.1634$ | .1315 | .3007 |
| $-.1807$ | .1310 | .2975 |
| $-.1960$ | .1306 | .2950 |
| $-.2126$ | .1303 | .2924 |
| $-.2291$ | .1301 | .2903 |
| $-.2454$ | .1300 | .2884 |
| $-.2651$ | .1299 | .2865 |
| $-.2834$ | .1299 | .2851 |
| $-.3057$ | .1300 | .2838 |
| $-.3307$ | .1302 | .2827 |
| $-.3593$ | .1304 | .2820 |
| $-.3928$ | .1306 | .2815 |
| $-.4404$ | .1310 | .2813 |
| $-.5060$ | .1314 | .2815 |
| $-.6163$ | .1318 | .2822 |
| $-.8549$ | .1323 | .2835 |
| $-1.9426$ | .1329 | .2867 |
| $-\infty$ | .1332 | .3104 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---------|---------|---------|
| .0000 | .0747 | .3088 |
| −.0113 | .0740 | .3053 |
| −.0237 | .0732 | .3015 |
| −.0354 | .0725 | .2981 |
| −.0466 | .0720 | .2948 |
| −.0573 | .0715 | .2918 |
| −.0674 | .0710 | .2890 |
| −.0782 | .0706 | .2860 |
| −.0873 | .0703 | .2836 |
| −.0981 | .0700 | .2809 |
| −.1072 | .0698 | .2786 |
| −.1166 | .0697 | .2764 |
| −.1255 | .0696 | .2743 |
| −.1337 | .0695 | .2725 |
| −.1428 | .0695 | .2706 |
| −.1504 | .0695 | .2690 |
| −.1587 | .0695 | .2674 |
| −.1665 | .0696 | .2659 |
| −.1739 | .0698 | .2646 |
| −.1806 | .0699 | .2635 |
| −.1875 | .0701 | .2624 |
| −.1936 | .0703 | .2615 |
| −.1987 | .0706 | .2607 |
| −.2018 | .0709 | .2600 |
| −.1973 | .0712 | .2594 |
| .0000 | .0714 | .2592 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| $-.0430$ | .1676 | .1298 | .3777 |
| $-.0385$ | .1716 | .1278 | .3864 |
| $-.0341$ | .1761 | .1256 | .3956 |
| $-.0304$ | .1804 | .1235 | .4043 |
| $-.0274$ | .1846 | .1215 | .4124 |
| $-.0251$ | .1886 | .1196 | .4200 |
| $-.0236$ | .1925 | .1178 | .4271 |
| $-.0227$ | .1967 | .1159 | .4344 |
| $-.0229$ | .2003 | .1143 | .4405 |
| $-.0242$ | .2046 | .1125 | .4475 |
| $-.0266$ | .2083 | .1109 | .4531 |
| $-.0306$ | .2122 | .1094 | .4589 |
| $-.0362$ | .2160 | .1080 | .4641 |
| $-.0435$ | .2195 | .1068 | .4688 |
| $-.0548$ | .2235 | .1056 | .4737 |
| $-.0677$ | .2270 | .1047 | .4777 |
| $-.0865$ | .2308 | .1038 | .4819 |
| $-.1119$ | .2345 | .1031 | .4857 |
| $-.1457$ | .2382 | .1027 | .4892 |
| $-.1907$ | .2416 | .1026 | .4923 |
| $-.2627$ | .2454 | .1029 | .4956 |
| $-.3724$ | .2490 | .1038 | .4986 |
| $-.5718$ | .2526 | .1056 | .5019 |
| $-1.0277$ | .2562 | .1092 | .5058 |
| $-3.1698$ | .2598 | .1180 | .5124 |
| $-\infty$ | .2617 | .4380 | .5590 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .0966 | .1540 | .3521 |
| .0109 | .0997 | .1505 | .3615 |
| .0228 | .1029 | .1466 | .3715 |
| .0342 | .1059 | .1429 | .3806 |
| .0451 | .1087 | .1392 | .3890 |
| .0556 | .1112 | .1357 | .3967 |
| .0655 | .1136 | .1324 | .4037 |
| .0762 | .1160 | .1287 | .4109 |
| .0853 | .1180 | .1256 | .4166 |
| .0960 | .1203 | .1219 | .4232 |
| .1052 | .1222 | .1187 | .4284 |
| .1149 | .1241 | .1153 | .4336 |
| .1240 | .1258 | .1121 | .4382 |
| .1326 | .1274 | .1091 | .4422 |
| .1422 | .1290 | .1058 | .4464 |
| .1504 | .1304 | .1029 | .4497 |
| .1594 | .1318 | .0998 | .4530 |
| .1683 | .1331 | .0968 | .4560 |
| .1769 | .1343 | .0939 | .4585 |
| .1850 | .1353 | .0911 | .4606 |
| .1939 | .1364 | .0882 | .4626 |
| .2024 | .1373 | .0853 | .4643 |
| .2110 | .1382 | .0824 | .4656 |
| .2196 | .1390 | .0791 | .4667 |
| .2266 | .1398 | .0746 | .4674 |
| .0000 | .1402 | .0583 | .4676 |

# tableaux 20

## $\alpha = 1.6$ et $\gamma = 1.67$

Ecoulement de base

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9930 | .9981 | 1.0064 | 1.0031 |
| .9863 | .9959 | 1.0126 | 1.0059 |
| .9793 | .9932 | 1.0190 | 1.0084 |
| .9725 | .9902 | 1.0253 | 1.0106 |
| .9659 | .9869 | 1.0314 | 1.0124 |
| .9592 | .9832 | 1.0376 | 1.0140 |
| .9527 | .9791 | 1.0438 | 1.0152 |
| .9464 | .9747 | 1.0497 | 1.0162 |
| .9403 | .9700 | 1.0555 | 1.0169 |
| .9342 | .9648 | 1.0614 | 1.0174 |
| .9280 | .9590 | 1.0674 | 1.0177 |
| .9220 | .9529 | 1.0732 | 1.0178 |
| .9164 | .9465 | 1.0788 | 1.0176 |
| .9105 | .9391 | 1.0847 | 1.0172 |
| .9049 | .9314 | 1.0904 | 1.0167 |
| .8995 | .9230 | 1.0959 | 1.0160 |
| .8940 | .9134 | 1.1016 | 1.0150 |
| .8888 | .9030 | 1.1071 | 1.0140 |
| .8835 | .8909 | 1.1127 | 1.0128 |
| .8783 | .8765 | 1.1184 | 1.0114 |
| .8732 | .8593 | 1.1239 | 1.0099 |
| .8683 | .8377 | 1.1294 | 1.0083 |
| .8634 | .8060 | 1.1349 | 1.0066 |
| .8586 | .7439 | 1.1404 | 1.0049 |
| .8562 | .2366 | 1.1431 | 1.0041 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | −.3350 |
| 1.0134 | 1.0172 | −.3165 |
| 1.0267 | 1.0341 | −.2987 |
| 1.0406 | 1.0515 | −.2805 |
| 1.0542 | 1.0685 | −.2629 |
| 1.0677 | 1.0850 | −.2461 |
| 1.0818 | 1.1021 | −.2290 |
| 1.0956 | 1.1186 | −.2127 |
| 1.1092 | 1.1346 | −.1972 |
| 1.1225 | 1.1501 | −.1823 |
| 1.1362 | 1.1659 | −.1674 |
| 1.1503 | 1.1819 | −.1525 |
| 1.1640 | 1.1972 | −.1385 |
| 1.1773 | 1.2118 | −.1254 |
| 1.1914 | 1.2271 | −.1118 |
| 1.2049 | 1.2415 | −.0992 |
| 1.2184 | 1.2557 | −.0871 |
| 1.2322 | 1.2700 | −.0750 |
| 1.2456 | 1.2836 | −.0637 |
| 1.2594 | 1.2973 | −.0526 |
| 1.2733 | 1.3111 | −.0417 |
| 1.2871 | 1.3244 | −.0314 |
| 1.3006 | 1.3373 | −.0217 |
| 1.3145 | 1.3503 | −.0123 |
| 1.3281 | 1.3631 | −.0038 |
| 1.3350 | 1.3695 | .0000 |

Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0080 | .1168 | $-.7611$ | $-1.1793$ | .1950 |
| .0017 | .1112 | $-.7586$ | $-1.2043$ | .1852 |
| $-.0045$ | .1058 | $-.7559$ | $-1.2287$ | .1756 |
| $-.0110$ | .1002 | $-.7528$ | $-1.2541$ | .1657 |
| $-.0173$ | .0947 | $-.7493$ | $-1.2788$ | .1561 |
| $-.0236$ | .0894 | $-.7456$ | $-1.3028$ | .1469 |
| $-.0301$ | .0840 | $-.7413$ | $-1.3276$ | .1374 |
| $-.0365$ | .0788 | $-.7367$ | $-1.3516$ | .1282 |
| $-.0428$ | .0737 | $-.7319$ | $-1.3749$ | .1194 |
| $-.0490$ | .0687 | $-.7267$ | $-1.3974$ | .1110 |
| $-.0554$ | .0637 | $-.7209$ | $-1.4204$ | .1024 |
| $-.0622$ | .0586 | $-.7145$ | $-1.4437$ | .0939 |
| $-.0688$ | .0538 | $-.7078$ | $-1.4660$ | .0857 |
| $-.0754$ | .0491 | $-.7007$ | $-1.4874$ | .0780 |
| $-.0825$ | .0443 | $-.6927$ | $-1.5097$ | .0700 |
| $-.0896$ | .0397 | $-.6844$ | $-1.5308$ | .0626 |
| $-.0970$ | .0352 | $-.6754$ | $-1.5515$ | .0553 |
| $-.1049$ | .0307 | $-.6655$ | $-1.5725$ | .0481 |
| $-.1130$ | .0264 | $-.6550$ | $-1.5925$ | .0412 |
| $-.1219$ | .0221 | $-.6435$ | $-1.6127$ | .0344 |
| $-.1319$ | .0178 | $-.6306$ | $-1.6329$ | .0276 |
| $-.1432$ | .0137 | $-.6168$ | $-1.6525$ | .0211 |
| $-.1563$ | .0097 | $-.6020$ | $-1.6715$ | .0150 |
| $-.1737$ | .0057 | $-.5862$ | $-1.6905$ | .0088 |
| $-.2026$ | .0019 | $-.5764$ | $-1.7090$ | .0029 |
| .0000 | .0000 | $-1.6085$ | $-1.7182$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1466 | $-.7611$ | $-1.1638$ |
| .0161 | $-.0076$ | .1388 | $-.7534$ | $-1.1743$ |
| .0325 | $-.0149$ | .1314 | $-.7456$ | $-1.1839$ |
| .0501 | $-.0225$ | .1238 | $-.7372$ | $-1.1932$ |
| .0681 | $-.0297$ | .1165 | $-.7287$ | $-1.2016$ |
| .0863 | $-.0367$ | .1095 | $-.7202$ | $-1.2092$ |
| .1059 | $-.0439$ | .1024 | $-.7111$ | $-1.2164$ |
| .1259 | $-.0509$ | .0956 | $-.7019$ | $-1.2229$ |
| .1462 | $-.0577$ | .0891 | $-.6926$ | $-1.2286$ |
| .1670 | $-.0643$ | .0829 | $-.6833$ | $-1.2337$ |
| .1892 | $-.0711$ | .0766 | $-.6735$ | $-1.2385$ |
| .2132 | $-.0781$ | .0703 | $-.6630$ | $-1.2428$ |
| .2376 | $-.0849$ | .0643 | $-.6526$ | $-1.2465$ |
| .2626 | $-.0916$ | .0586 | $-.6421$ | $-1.2496$ |
| .2907 | $-.0988$ | .0527 | $-.6307$ | $-1.2525$ |
| .3195 | $-.1058$ | .0472 | $-.6193$ | $-1.2549$ |
| .3503 | $-.1131$ | .0418 | $-.6075$ | $-1.2568$ |
| .3846 | $-.1208$ | .0364 | $-.5949$ | $-1.2584$ |
| .4213 | $-.1287$ | .0313 | $-.5822$ | $-1.2596$ |
| .4633 | $-.1374$ | .0262 | $-.5685$ | $-1.2605$ |
| .5123 | $-.1470$ | .0211 | $-.5539$ | $-1.2610$ |
| .5702 | $-.1578$ | .0162 | $-.5386$ | $-1.2613$ |
| .6418 | $-.1703$ | .0115 | $-.5227$ | $-1.2612$ |
| .7457 | $-.1871$ | .0068 | $-.5061$ | $-1.2608$ |
| .9475 | $-.2147$ | .0023 | $-.4949$ | $-1.2601$ |
| 4.7167 | .0000 | .0000 | $-1.3773$ | $-1.2597$ |

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**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-3.7550$ | $-.6280$ | $.5799$ |
| $-3.7193$ | $-.6363$ | $.5824$ |
| $-3.6804$ | $-.6443$ | $.5866$ |
| $-3.6357$ | $-.6525$ | $.5928$ |
| $-3.5879$ | $-.6604$ | $.6004$ |
| $-3.5370$ | $-.6681$ | $.6095$ |
| $-3.4800$ | $-.6760$ | $.6204$ |
| $-3.4197$ | $-.6837$ | $.6325$ |
| $-3.3564$ | $-.6912$ | $.6458$ |
| $-3.2898$ | $-.6986$ | $.6600$ |
| $-3.2162$ | $-.7062$ | $.6759$ |
| $-3.1347$ | $-.7141$ | $.6934$ |
| $-3.0491$ | $-.7218$ | $.7116$ |
| $-2.9591$ | $-.7293$ | $.7303$ |
| $-2.8547$ | $-.7374$ | $.7512$ |
| $-2.7440$ | $-.7452$ | $.7722$ |
| $-2.6208$ | $-.7531$ | $.7940$ |
| $-2.4771$ | $-.7614$ | $.8172$ |
| $-2.3150$ | $-.7695$ | $.8404$ |
| $-2.1159$ | $-.7779$ | $.8647$ |
| $-1.8602$ | $-.7866$ | $.8899$ |
| $-1.5159$ | $-.7954$ | $.9149$ |
| $-1.0002$ | $-.8042$ | $.9389$ |
| $.0293$ | $-.8134$ | $.9620$ |
| $4.1114$ | $-.8225$ | $.9788$ |
| $+\infty$ | $-.8271$ | $.9026$ |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-3.6853$ | $-.8881$ | .4453 | $-.1899$ |
| $-3.6420$ | $-.8681$ | .4641 | $-.1836$ |
| $-3.5981$ | $-.8488$ | .4815 | $-.1773$ |
| $-3.5509$ | $-.8288$ | .4986 | $-.1706$ |
| $-3.5029$ | $-.8094$ | .5142 | $-.1639$ |
| $-3.4543$ | $-.7904$ | .5287 | $-.1573$ |
| $-3.4021$ | $-.7708$ | .5427 | $-.1504$ |
| $-3.3492$ | $-.7517$ | .5554 | $-.1435$ |
| $-3.2956$ | $-.7330$ | .5670 | $-.1367$ |
| $-3.2412$ | $-.7147$ | .5775 | $-.1299$ |
| $-3.1830$ | $-.6958$ | .5875 | $-.1229$ |
| $-3.1209$ | $-.6765$ | .5968 | $-.1157$ |
| $-3.0578$ | $-.6576$ | .6049 | $-.1085$ |
| $-2.9938$ | $-.6393$ | .6120 | $-.1015$ |
| $-2.9223$ | $-.6198$ | .6186 | $-.0940$ |
| $-2.8497$ | $-.6011$ | .6240 | $-.0866$ |
| $-2.7725$ | $-.5823$ | .6286 | $-.0791$ |
| $-2.6873$ | $-.5629$ | .6324 | $-.0713$ |
| $-2.5973$ | $-.5440$ | .6353 | $-.0635$ |
| $-2.4954$ | $-.5245$ | .6373 | $-.0553$ |
| $-2.3778$ | $-.5046$ | .6385 | $-.0466$ |
| $-2.2412$ | $-.4847$ | .6386 | $-.0376$ |
| $-2.0759$ | $-.4651$ | .6379 | $-.0283$ |
| $-1.8446$ | $-.4448$ | .6361 | $-.0181$ |
| $-1.4333$ | $-.4246$ | .6332 | $-.0067$ |
| .0000 | $-.4143$ | .6313 | .0000 |

**Ecoulement d'ordre 2**
effet isotrope du courant

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|:---:|:---:|:---:|
| $-.0028$ | .1760 | .4054 |
| $-.0194$ | .1737 | .4007 |
| $-.0353$ | .1716 | .3964 |
| $-.0515$ | .1698 | .3922 |
| $-.0671$ | .1682 | .3885 |
| $-.0822$ | .1668 | .3850 |
| $-.0977$ | .1656 | .3817 |
| $-.1126$ | .1646 | .3788 |
| $-.1272$ | .1638 | .3761 |
| $-.1413$ | .1632 | .3737 |
| $-.1560$ | .1627 | .3714 |
| $-.1712$ | .1623 | .3693 |
| $-.1861$ | .1621 | .3674 |
| $-.2010$ | .1620 | .3658 |
| $-.2174$ | .1620 | .3644 |
| $-.2340$ | .1621 | .3632 |
| $-.2517$ | .1623 | .3622 |
| $-.2718$ | .1626 | .3614 |
| $-.2940$ | .1630 | .3608 |
| $-.3211$ | .1636 | .3605 |
| $-.3562$ | .1642 | .3605 |
| $-.4048$ | .1649 | .3608 |
| $-.4816$ | .1656 | .3615 |
| $-.6480$ | .1665 | .3628 |
| $-1.3916$ | .1674 | .3656 |
| $-\infty$ | .1678 | .3841 |

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| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .0879 | .3457 |
| −.0118 | .0867 | .3424 |
| −.0232 | .0856 | .3392 |
| −.0347 | .0846 | .3360 |
| −.0458 | .0838 | .3329 |
| −.0565 | .0830 | .3299 |
| −.0673 | .0824 | .3268 |
| −.0776 | .0818 | .3239 |
| −.0875 | .0814 | .3212 |
| −.0970 | .0811 | .3186 |
| −.1066 | .0808 | .3159 |
| −.1162 | .0806 | .3133 |
| −.1253 | .0805 | .3109 |
| −.1340 | .0805 | .3086 |
| −.1431 | .0805 | .3062 |
| −.1516 | .0806 | .3040 |
| −.1599 | .0808 | .3019 |
| −.1684 | .0810 | .2999 |
| −.1764 | .0812 | .2980 |
| −.1846 | .0816 | .2961 |
| −.1927 | .0819 | .2943 |
| −.2007 | .0823 | .2927 |
| −.2082 | .0828 | .2911 |
| −.2152 | .0833 | .2897 |
| −.2182 | .0838 | .2884 |
| .0000 | .0841 | .2878 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| .0003 | .1684 | .1258 | .4060 |
| .0065 | .1753 | .1256 | .4207 |
| .0123 | .1820 | .1255 | .4349 |
| .0179 | .1890 | .1256 | .4493 |
| .0229 | .1958 | .1257 | .4632 |
| .0273 | .2024 | .1260 | .4764 |
| .0314 | .2093 | .1264 | .4897 |
| .0348 | .2160 | .1270 | .5024 |
| .0374 | .2225 | .1277 | .5144 |
| .0393 | .2289 | .1285 | .5257 |
| .0405 | .2355 | .1295 | .5369 |
| .0406 | .2422 | .1307 | .5480 |
| .0395 | .2487 | .1320 | .5584 |
| .0371 | .2549 | .1335 | .5679 |
| .0327 | .2616 | .1354 | .5776 |
| .0263 | .2680 | .1374 | .5865 |
| .0170 | .2743 | .1397 | .5949 |
| .0034 | .2809 | .1424 | .6030 |
| $-.0156$ | .2872 | .1455 | .6105 |
| $-.0438$ | .2938 | .1492 | .6177 |
| $-.0875$ | .3004 | .1536 | .6247 |
| $-.1583$ | .3071 | .1590 | .6313 |
| $-.2851$ | .3136 | .1658 | .6375 |
| $-.5887$ | .3204 | .1756 | .6442 |
| $-2.0363$ | .3272 | .1929 | .6525 |
| $-\infty$ | .3307 | .4736 | .6901 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .0917 | .1435 | .3521 |
| .0113 | .0969 | .1420 | .3661 |
| .0221 | .1017 | .1405 | .3791 |
| .0333 | .1065 | .1390 | .3919 |
| .0440 | .1110 | .1375 | .4036 |
| .0544 | .1152 | .1362 | .4145 |
| .0650 | .1193 | .1348 | .4250 |
| .0752 | .1231 | .1336 | .4347 |
| .0851 | .1266 | .1324 | .4435 |
| .0946 | .1299 | .1313 | .4516 |
| .1042 | .1332 | .1303 | .4594 |
| .1140 | .1363 | .1293 | .4668 |
| .1234 | .1392 | .1284 | .4734 |
| .1325 | .1419 | .1276 | .4794 |
| .1420 | .1446 | .1268 | .4852 |
| .1511 | .1470 | .1262 | .4902 |
| .1601 | .1493 | .1256 | .4949 |
| .1695 | .1516 | .1251 | .4992 |
| .1786 | .1537 | .1247 | .5029 |
| .1881 | .1557 | .1244 | .5064 |
| .1980 | .1577 | .1242 | .5095 |
| .2082 | .1595 | .1241 | .5121 |
| .2189 | .1613 | .1241 | .5143 |
| .2309 | .1630 | .1240 | .5161 |
| .2449 | .1647 | .1225 | .5176 |
| .0000 | .1656 | .0959 | .5181 |

# tableaux 21

## $\alpha = 1.8$ et $\gamma = 1.33$

Ecoulement de base

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|---------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9968 | .9996 | 1.0032 | 1.0019 |
| .9934 | .9989 | 1.0065 | 1.0038 |
| .9900 | .9981 | 1.0098 | 1.0054 |
| .9867 | .9970 | 1.0131 | 1.0069 |
| .9834 | .9958 | 1.0162 | 1.0083 |
| .9800 | .9942 | 1.0196 | 1.0095 |
| .9769 | .9926 | 1.0226 | 1.0105 |
| .9737 | .9906 | 1.0258 | 1.0114 |
| .9705 | .9884 | 1.0289 | 1.0122 |
| .9672 | .9858 | 1.0322 | 1.0129 |
| .9640 | .9830 | 1.0353 | 1.0134 |
| .9609 | .9800 | 1.0384 | 1.0138 |
| .9578 | .9765 | 1.0415 | 1.0140 |
| .9548 | .9728 | 1.0446 | 1.0141 |
| .9517 | .9685 | 1.0476 | 1.0141 |
| .9486 | .9637 | 1.0507 | 1.0140 |
| .9456 | .9583 | 1.0538 | 1.0138 |
| .9426 | .9522 | 1.0569 | 1.0135 |
| .9397 | .9450 | 1.0599 | 1.0131 |
| .9368 | .9368 | 1.0629 | 1.0125 |
| .9339 | .9265 | 1.0659 | 1.0119 |
| .9310 | .9129 | 1.0689 | 1.0112 |
| .9282 | .8932 | 1.0719 | 1.0103 |
| .9254 | .8531 | 1.0749 | 1.0095 |
| .9240 | .3006 | 1.0764 | 1.0090 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | $-.1650$ |
| 1.0064 | 1.0084 | $-.1575$ |
| 1.0133 | 1.0172 | $-.1496$ |
| 1.0200 | 1.0259 | $-.1418$ |
| 1.0267 | 1.0343 | $-.1342$ |
| 1.0333 | 1.0425 | $-.1268$ |
| 1.0403 | 1.0511 | $-.1190$ |
| 1.0467 | 1.0588 | $-.1120$ |
| 1.0535 | 1.0668 | $-.1047$ |
| 1.0602 | 1.0746 | $-.0976$ |
| 1.0671 | 1.0827 | $-.0903$ |
| 1.0739 | 1.0904 | $-.0832$ |
| 1.0806 | 1.0978 | $-.0764$ |
| 1.0874 | 1.1054 | $-.0695$ |
| 1.0941 | 1.1125 | $-.0629$ |
| 1.1008 | 1.1197 | $-.0563$ |
| 1.1077 | 1.1269 | $-.0497$ |
| 1.1145 | 1.1339 | $-.0433$ |
| 1.1212 | 1.1406 | $-.0371$ |
| 1.1280 | 1.1473 | $-.0309$ |
| 1.1346 | 1.1538 | $-.0250$ |
| 1.1413 | 1.1602 | $-.0192$ |
| 1.1481 | 1.1666 | $-.0134$ |
| 1.1548 | 1.1728 | $-.0078$ |
| 1.1616 | 1.1789 | $-.0025$ |
| 1.1650 | 1.1819 | $.0000$ |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0021 | .0421 | −.6286 | −1.1007 | .0909 |
| .0000 | .0400 | −.6218 | −1.1108 | .0866 |
| −.0023 | .0378 | −.6141 | −1.1215 | .0821 |
| −.0046 | .0357 | −.6063 | −1.1319 | .0777 |
| −.0070 | .0336 | −.5982 | −1.1421 | .0734 |
| −.0094 | .0316 | −.5898 | −1.1520 | .0693 |
| −.0120 | .0294 | −.5806 | −1.1624 | .0649 |
| −.0144 | .0275 | −.5718 | −1.1718 | .0610 |
| −.0170 | .0256 | −.5621 | −1.1816 | .0568 |
| −.0197 | .0237 | −.5522 | −1.1911 | .0529 |
| −.0226 | .0217 | −.5412 | −1.2010 | .0488 |
| −.0256 | .0198 | −.5300 | −1.2104 | .0449 |
| −.0286 | .0181 | −.5185 | −1.2196 | .0411 |
| −.0319 | .0163 | −.5060 | −1.2289 | .0373 |
| −.0352 | .0146 | −.4932 | −1.2377 | .0337 |
| −.0387 | .0129 | −.4794 | −1.2467 | .0301 |
| −.0426 | .0112 | −.4645 | −1.2556 | .0265 |
| −.0468 | .0096 | −.4487 | −1.2644 | .0230 |
| −.0513 | .0081 | −.4319 | −1.2729 | .0197 |
| −.0563 | .0067 | −.4135 | −1.2814 | .0164 |
| −.0618 | .0053 | −.3937 | −1.2896 | .0133 |
| −.0685 | .0039 | −.3714 | −1.2978 | .0102 |
| −.0768 | .0027 | −.3453 | −1.3060 | .0071 |
| −.0882 | .0015 | −.3141 | −1.3141 | .0042 |
| −.1091 | .0005 | −.2720 | −1.3220 | .0014 |
| .0000 | .0000 | −.5789 | −1.3260 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0633 | −.6286 | −1.0875 |
| .0125 | −.0032 | .0601 | −.6198 | −1.0920 |
| .0262 | −.0067 | .0568 | −.6100 | −1.0964 |
| .0401 | −.0100 | .0536 | −.6002 | −1.1005 |
| .0542 | −.0133 | .0505 | −.5902 | −1.1042 |
| .0686 | −.0165 | .0475 | −.5801 | −1.1076 |
| .0843 | −.0198 | .0444 | −.5690 | −1.1110 |
| .0992 | −.0229 | .0416 | −.5587 | −1.1138 |
| .1155 | −.0262 | .0387 | −.5473 | −1.1165 |
| .1320 | −.0294 | .0360 | −.5359 | −1.1190 |
| .1501 | −.0328 | .0331 | −.5235 | −1.1213 |
| .1685 | −.0362 | .0304 | −.5109 | −1.1233 |
| .1872 | −.0395 | .0278 | −.4983 | −1.1251 |
| .2076 | −.0431 | .0252 | −.4846 | −1.1267 |
| .2284 | −.0466 | .0227 | −.4709 | −1.1281 |
| .2509 | −.0503 | .0202 | −.4562 | −1.1293 |
| .2751 | −.0543 | .0177 | −.4407 | −1.1303 |
| .3013 | −.0585 | .0154 | −.4243 | −1.1311 |
| .3292 | −.0630 | .0131 | −.4071 | −1.1317 |
| .3605 | −.0679 | .0108 | −.3886 | −1.1322 |
| .3952 | −.0734 | .0087 | −.3688 | −1.1324 |
| .4359 | −.0798 | .0066 | −.3468 | −1.1326 |
| .4869 | −.0879 | .0046 | −.3215 | −1.1326 |
| .5553 | −.0989 | .0027 | −.2916 | −1.1324 |
| .6795 | −.1191 | .0009 | −.2517 | −1.1321 |
| 3.4797 | .0000 | .0000 | −.5348 | −1.1320 |

**Ecoulement d'ordre 2
effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| −6.7384 | −.6197 | .5224 |
| −6.7142 | −.6231 | .5227 |
| −6.6845 | −.6267 | .5243 |
| −6.6513 | −.6302 | .5271 |
| −6.6145 | −.6336 | .5311 |
| −6.5743 | −.6369 | .5361 |
| −6.5270 | −.6404 | .5426 |
| −6.4795 | −.6436 | .5496 |
| −6.4244 | −.6470 | .5581 |
| −6.3651 | −.6503 | .5674 |
| −6.2967 | −.6537 | .5783 |
| −6.2231 | −.6572 | .5899 |
| −6.1441 | −.6606 | .6022 |
| −6.0534 | −.6641 | .6160 |
| −5.9555 | −.6676 | .6302 |
| −5.8429 | −.6712 | .6456 |
| −5.7130 | −.6749 | .6621 |
| −5.5621 | −.6787 | .6794 |
| −5.3855 | −.6826 | .6972 |
| −5.1661 | −.6865 | .7159 |
| −4.8893 | −.6905 | .7349 |
| −4.5024 | −.6946 | .7547 |
| −3.8841 | −.6989 | .7750 |
| −2.6583 | −.7033 | .7948 |
| 2.3972 | −.7078 | .8120 |
| $+\infty$ | −.7100 | .7508 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −6.7154 | −.8496 | .3793 | −.0771 |
| −6.6808 | −.8293 | .3990 | −.0752 |
| −6.6426 | −.8077 | .4190 | −.0730 |
| −6.6036 | −.7867 | .4376 | −.0708 |
| −6.5637 | −.7661 | .4549 | −.0685 |
| −6.5229 | −.7460 | .4710 | −.0662 |
| −6.4779 | −.7248 | .4870 | −.0637 |
| −6.4351 | −.7056 | .5007 | −.0614 |
| −6.3879 | −.6854 | .5143 | −.0589 |
| −6.3394 | −.6656 | .5266 | −.0564 |
| −6.2861 | −.6450 | .5387 | −.0536 |
| −6.2312 | −.6250 | .5495 | −.0509 |
| −6.1747 | −.6055 | .5591 | −.0482 |
| −6.1127 | −.5854 | .5682 | −.0453 |
| −6.0486 | −.5660 | .5761 | −.0424 |
| −5.9783 | −.5462 | .5833 | −.0394 |
| −5.9013 | −.5262 | .5897 | −.0362 |
| −5.8169 | −.5062 | .5951 | −.0329 |
| −5.7247 | −.4866 | .5997 | −.0295 |
| −5.6191 | −.4667 | .6034 | −.0259 |
| −5.4992 | −.4472 | .6061 | −.0221 |
| −5.3535 | −.4275 | .6080 | −.0180 |
| −5.1640 | −.4073 | .6091 | −.0135 |
| −4.8961 | −.3873 | .6092 | −.0085 |
| −4.3808 | −.3672 | .6083 | −.0025 |
| .0000 | −.3569 | .6075 | .0005 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| .0033 | .1260 | .3161 |
| −.0096 | .1248 | .3110 |
| −.0233 | .1237 | .3058 |
| −.0367 | .1226 | .3009 |
| −.0499 | .1217 | .2962 |
| −.0629 | .1209 | .2918 |
| −.0768 | .1201 | .2874 |
| −.0895 | .1195 | .2835 |
| −.1031 | .1189 | .2796 |
| −.1167 | .1184 | .2759 |
| −.1311 | .1179 | .2723 |
| −.1456 | .1176 | .2689 |
| −.1602 | .1173 | .2658 |
| −.1760 | .1171 | .2628 |
| −.1920 | .1169 | .2601 |
| −.2095 | .1168 | .2575 |
| −.2288 | .1167 | .2550 |
| −.2503 | .1168 | .2528 |
| −.2747 | .1168 | .2508 |
| −.3042 | .1170 | .2490 |
| −.3410 | .1171 | .2474 |
| −.3924 | .1174 | .2460 |
| −.4763 | .1177 | .2449 |
| −.6501 | .1180 | .2442 |
| −1.4250 | .1184 | .2442 |
| $-\infty$ | .1186 | .2559 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .0599 | .2679 |
| −.0092 | .0595 | .2650 |
| −.0189 | .0590 | .2620 |
| −.0284 | .0587 | .2592 |
| −.0377 | .0583 | .2564 |
| −.0468 | .0581 | .2539 |
| −.0565 | .0578 | .2512 |
| −.0652 | .0577 | .2489 |
| −.0744 | .0575 | .2466 |
| −.0835 | .0574 | .2444 |
| −.0930 | .0573 | .2423 |
| −.1022 | .0573 | .2402 |
| −.1113 | .0573 | .2384 |
| −.1207 | .0573 | .2365 |
| −.1299 | .0574 | .2349 |
| −.1394 | .0575 | .2333 |
| −.1491 | .0576 | .2318 |
| −.1591 | .0578 | .2304 |
| −.1691 | .0579 | .2292 |
| −.1797 | .0581 | .2280 |
| −.1906 | .0583 | .2270 |
| −.2024 | .0586 | .2261 |
| −.2156 | .0589 | .2254 |
| −.2306 | .0592 | .2247 |
| −.2494 | .0595 | .2243 |
| .0000 | .0596 | .2241 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| .0014 | .1762 | .1323 | .3910 |
| .0058 | .1790 | .1300 | .3964 |
| .0101 | .1819 | .1276 | .4019 |
| .0141 | .1848 | .1252 | .4071 |
| .0177 | .1877 | .1228 | .4119 |
| .0209 | .1904 | .1205 | .4164 |
| .0238 | .1933 | .1181 | .4210 |
| .0261 | .1959 | .1159 | .4249 |
| .0280 | .1987 | .1137 | .4287 |
| .0294 | .2013 | .1114 | .4322 |
| .0300 | .2041 | .1092 | .4356 |
| .0298 | .2068 | .1070 | .4386 |
| .0286 | .2094 | .1049 | .4413 |
| .0261 | .2120 | .1028 | .4438 |
| .0221 | .2146 | .1008 | .4460 |
| .0160 | .2172 | .0989 | .4479 |
| .0070 | .2198 | .0970 | .4496 |
| −.0059 | .2224 | .0952 | .4510 |
| −.0242 | .2249 | .0937 | .4521 |
| −.0516 | .2274 | .0922 | .4530 |
| −.0926 | .2299 | .0911 | .4536 |
| −.1606 | .2324 | .0903 | .4541 |
| −.2898 | .2349 | .0900 | .4543 |
| −.5947 | .2374 | .0909 | .4546 |
| −2.1030 | .2399 | .0954 | .4555 |
| −∞ | .2411 | .2837 | .4795 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .0920 | .1615 | .3316 |
| .0093 | .0941 | .1583 | .3387 |
| .0192 | .0963 | .1548 | .3459 |
| .0288 | .0984 | .1513 | .3526 |
| .0382 | .1003 | .1479 | .3589 |
| .0474 | .1021 | .1445 | .3647 |
| .0572 | .1039 | .1408 | .3705 |
| .0660 | .1055 | .1375 | .3755 |
| .0753 | .1070 | .1340 | .3804 |
| .0845 | .1084 | .1306 | .3850 |
| .0940 | .1099 | .1269 | .3894 |
| .1034 | .1111 | .1234 | .3934 |
| .1125 | .1123 | .1200 | .3970 |
| .1221 | .1135 | .1164 | .4005 |
| .1314 | .1145 | .1130 | .4035 |
| .1411 | .1155 | .1095 | .4064 |
| .1511 | .1164 | .1059 | .4090 |
| .1613 | .1172 | .1024 | .4113 |
| .1718 | .1180 | .0990 | .4134 |
| .1828 | .1187 | .0955 | .4152 |
| .1944 | .1193 | .0921 | .4167 |
| .2072 | .1198 | .0887 | .4181 |
| .2219 | .1203 | .0853 | .4192 |
| .2399 | .1207 | .0819 | .4200 |
| .2692 | .1211 | .0785 | .4206 |
| .0000 | .1212 | .0788 | .4207 |

# tableaux 22

## $\alpha = 1.8$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9962 | 1.0001 | 1.0038 | 1.0026 |
| .9919 | .9999 | 1.0081 | 1.0052 |
| .9880 | .9995 | 1.0120 | 1.0074 |
| .9841 | .9989 | 1.0159 | 1.0095 |
| .9801 | .9980 | 1.0199 | 1.0114 |
| .9762 | .9969 | 1.0239 | 1.0131 |
| .9723 | .9955 | 1.0277 | 1.0146 |
| .9686 | .9939 | 1.0315 | 1.0160 |
| .9647 | .9920 | 1.0354 | 1.0172 |
| .9609 | .9898 | 1.0392 | 1.0182 |
| .9572 | .9874 | 1.0430 | 1.0190 |
| .9535 | .9846 | 1.0468 | 1.0197 |
| .9499 | .9815 | 1.0505 | 1.0202 |
| .9462 | .9780 | 1.0542 | 1.0206 |
| .9427 | .9742 | 1.0578 | 1.0208 |
| .9390 | .9696 | 1.0616 | 1.0209 |
| .9356 | .9646 | 1.0652 | 1.0208 |
| .9321 | .9588 | 1.0689 | 1.0206 |
| .9286 | .9520 | 1.0726 | 1.0203 |
| .9252 | .9441 | 1.0762 | 1.0199 |
| .9219 | .9343 | 1.0798 | 1.0193 |
| .9186 | .9215 | 1.0834 | 1.0186 |
| .9152 | .9023 | 1.0870 | 1.0179 |
| .9120 | .8636 | 1.0906 | 1.0170 |
| .9103 | .3303 | 1.0924 | 1.0165 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0077 | 1.0102 | $-.1909$ |
| 1.0163 | 1.0216 | $-.1807$ |
| 1.0243 | 1.0320 | $-.1714$ |
| 1.0323 | 1.0423 | $-.1623$ |
| 1.0406 | 1.0528 | $-.1528$ |
| 1.0489 | 1.0632 | $-.1436$ |
| 1.0570 | 1.0732 | $-.1346$ |
| 1.0650 | 1.0830 | $-.1259$ |
| 1.0733 | 1.0930 | $-.1169$ |
| 1.0815 | 1.1027 | $-.1083$ |
| 1.0896 | 1.1121 | $-.0999$ |
| 1.0978 | 1.1216 | $-.0915$ |
| 1.1059 | 1.1307 | $-.0833$ |
| 1.1142 | 1.1399 | $-.0752$ |
| 1.1221 | 1.1487 | $-.0674$ |
| 1.1306 | 1.1577 | $-.0594$ |
| 1.1386 | 1.1662 | $-.0519$ |
| 1.1468 | 1.1748 | $-.0443$ |
| 1.1551 | 1.1833 | $-.0369$ |
| 1.1632 | 1.1914 | $-.0298$ |
| 1.1713 | 1.1994 | $-.0228$ |
| 1.1794 | 1.2073 | $-.0160$ |
| 1.1877 | 1.2152 | $-.0093$ |
| 1.1959 | 1.2228 | $-.0029$ |
| 1.2000 | 1.2266 | $.0000$ |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-.0011$ | .0523 | $-.6522$ | $-1.1156$ | .1119 |
| $-.0031$ | .0498 | $-.6463$ | $-1.1278$ | .1067 |
| $-.0053$ | .0471 | $-.6394$ | $-1.1413$ | .1009 |
| $-.0075$ | .0445 | $-.6327$ | $-1.1538$ | .0956 |
| $-.0097$ | .0421 | $-.6257$ | $-1.1660$ | .0903 |
| $-.0121$ | .0395 | $-.6180$ | $-1.1787$ | .0849 |
| $-.0145$ | .0370 | $-.6100$ | $-1.1911$ | .0797 |
| $-.0169$ | .0346 | $-.6017$ | $-1.2032$ | .0746 |
| $-.0194$ | .0322 | $-.5931$ | $-1.2149$ | .0696 |
| $-.0221$ | .0298 | $-.5837$ | $-1.2271$ | .0646 |
| $-.0248$ | .0274 | $-.5740$ | $-1.2388$ | .0597 |
| $-.0276$ | .0252 | $-.5639$ | $-1.2502$ | .0550 |
| $-.0306$ | .0229 | $-.5529$ | $-1.2618$ | .0502 |
| $-.0337$ | .0207 | $-.5416$ | $-1.2730$ | .0457 |
| $-.0370$ | .0186 | $-.5294$ | $-1.2842$ | .0411 |
| $-.0404$ | .0165 | $-.5168$ | $-1.2950$ | .0368 |
| $-.0442$ | .0144 | $-.5026$ | $-1.3062$ | .0323 |
| $-.0482$ | .0125 | $-.4880$ | $-1.3167$ | .0282 |
| $-.0526$ | .0105 | $-.4719$ | $-1.3274$ | .0241 |
| $-.0576$ | .0086 | $-.4542$ | $-1.3380$ | .0200 |
| $-.0631$ | .0069 | $-.4351$ | $-1.3482$ | .0162 |
| $-.0695$ | .0052 | $-.4138$ | $-1.3583$ | .0124 |
| $-.0777$ | .0036 | $-.3889$ | $-1.3684$ | .0087 |
| $-.0891$ | .0020 | $-.3584$ | $-1.3785$ | .0051 |
| $-.1100$ | .0006 | $-.3180$ | $-1.3883$ | .0017 |
| .0000 | .0000 | $-.6538$ | $-1.3932$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0778 | −.6522 | −1.0981 |
| .0126 | −.0033 | .0740 | −.6439 | −1.1035 |
| .0272 | −.0070 | .0698 | −.6343 | −1.1093 |
| .0412 | −.0104 | .0660 | −.6251 | −1.1142 |
| .0555 | −.0137 | .0622 | −.6158 | −1.1188 |
| .0710 | −.0171 | .0584 | −.6057 | −1.1233 |
| .0868 | −.0204 | .0547 | −.5955 | −1.1273 |
| .1029 | −.0237 | .0512 | −.5851 | −1.1310 |
| .1194 | −.0269 | .0477 | −.5745 | −1.1344 |
| .1372 | −.0303 | .0442 | −.5631 | −1.1375 |
| .1555 | −.0336 | .0408 | −.5515 | −1.1404 |
| .1741 | −.0369 | .0375 | −.5398 | −1.1429 |
| .1943 | −.0404 | .0343 | −.5272 | −1.1452 |
| .2151 | −.0438 | .0311 | −.5145 | −1.1472 |
| .2375 | −.0474 | .0280 | −.5009 | −1.1489 |
| .2605 | −.0511 | .0250 | −.4872 | −1.1504 |
| .2865 | −.0551 | .0220 | −.4719 | −1.1518 |
| .3134 | −.0591 | .0191 | −.4566 | −1.1528 |
| .3435 | −.0636 | .0163 | −.4398 | −1.1537 |
| .3772 | −.0686 | .0135 | −.4218 | −1.1543 |
| .4145 | −.0740 | .0109 | −.4026 | −1.1548 |
| .4584 | −.0803 | .0083 | −.3814 | −1.1550 |
| .5133 | −.0882 | .0058 | −.3573 | −1.1551 |
| .5901 | −.0993 | .0034 | −.3281 | −1.1550 |
| .7310 | −.1196 | .0011 | −.2900 | −1.1548 |
| 3.8358 | .0000 | .0000 | −.5952 | −1.1546 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-5.5297$ | $-.6033$ | .5349 |
| $-5.5147$ | $-.6076$ | .5339 |
| $-5.4942$ | $-.6122$ | .5341 |
| $-5.4716$ | $-.6164$ | .5356 |
| $-5.4459$ | $-.6205$ | .5383 |
| $-5.4150$ | $-.6247$ | .5424 |
| $-5.3807$ | $-.6288$ | .5476 |
| $-5.3428$ | $-.6328$ | .5540 |
| $-5.3014$ | $-.6367$ | .5613 |
| $-5.2535$ | $-.6409$ | .5700 |
| $-5.2014$ | $-.6449$ | .5798 |
| $-5.1449$ | $-.6489$ | .5903 |
| $-5.0802$ | $-.6530$ | .6023 |
| $-5.0099$ | $-.6571$ | .6149 |
| $-4.9295$ | $-.6613$ | .6289 |
| $-4.8418$ | $-.6655$ | .6433 |
| $-4.7358$ | $-.6699$ | .6595 |
| $-4.6184$ | $-.6742$ | .6759 |
| $-4.4749$ | $-.6788$ | .6935 |
| $-4.2975$ | $-.6834$ | .7121 |
| $-4.0743$ | $-.6881$ | .7310 |
| $-3.7651$ | $-.6928$ | .7506 |
| $-3.2781$ | $-.6978$ | .7708 |
| $-2.2852$ | $-.7029$ | .7912 |
| $1.7861$ | $-.7081$ | .8094 |
| $+\infty$ | $-.7107$ | .7613 |

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| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-5.5402$ | $-.8442$ | .3695 | $-.0955$ |
| $-5.5125$ | $-.8237$ | .3894 | $-.0922$ |
| $-5.4803$ | $-.8010$ | .4105 | $-.0885$ |
| $-5.4494$ | $-.7802$ | .4289 | $-.0850$ |
| $-5.4176$ | $-.7599$ | .4461 | $-.0816$ |
| $-5.3831$ | $-.7387$ | .4631 | $-.0779$ |
| $-5.3476$ | $-.7181$ | .4787 | $-.0743$ |
| $-5.3111$ | $-.6978$ | .4932 | $-.0706$ |
| $-5.2736$ | $-.6780$ | .5065 | $-.0671$ |
| $-5.2327$ | $-.6576$ | .5193 | $-.0633$ |
| $-5.1905$ | $-.6375$ | .5310 | $-.0597$ |
| $-5.1470$ | $-.6180$ | .5415 | $-.0560$ |
| $-5.0996$ | $-.5979$ | .5515 | $-.0522$ |
| $-5.0506$ | $-.5783$ | .5603 | $-.0485$ |
| $-4.9970$ | $-.5583$ | .5685 | $-.0447$ |
| $-4.9415$ | $-.5391$ | .5755 | $-.0409$ |
| $-4.8778$ | $-.5187$ | .5820 | $-.0369$ |
| $-4.8115$ | $-.4993$ | .5873 | $-.0330$ |
| $-4.7358$ | $-.4794$ | .5919 | $-.0288$ |
| $-4.6498$ | $-.4593$ | .5956 | $-.0245$ |
| $-4.5525$ | $-.4397$ | .5984 | $-.0202$ |
| $-4.4354$ | $-.4200$ | .6003 | $-.0156$ |
| $-4.2855$ | $-.4000$ | .6014 | $-.0107$ |
| $-4.0693$ | $-.3795$ | .6015 | $-.0052$ |
| $-3.6735$ | $-.3593$ | .6007 | .0011 |
| .0000 | $-.3491$ | .6003 | .0019 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| .0115 | .1347 | .3336 |
| −.0013 | .1333 | .3284 |
| −.0154 | .1318 | .3229 |
| −.0285 | .1306 | .3180 |
| −.0413 | .1295 | .3134 |
| −.0548 | .1285 | .3088 |
| −.0680 | .1276 | .3044 |
| −.0812 | .1268 | .3003 |
| −.0942 | .1261 | .2965 |
| −.1079 | .1255 | .2926 |
| −.1216 | .1250 | .2891 |
| −.1353 | .1246 | .2858 |
| −.1498 | .1242 | .2826 |
| −.1645 | .1240 | .2796 |
| −.1803 | .1238 | .2768 |
| −.1965 | .1236 | .2742 |
| −.2150 | .1236 | .2717 |
| −.2345 | .1236 | .2695 |
| −.2573 | .1237 | .2675 |
| −.2845 | .1239 | .2656 |
| −.3179 | .1241 | .2640 |
| −.3636 | .1243 | .2626 |
| −.4360 | .1247 | .2615 |
| −.5882 | .1251 | .2607 |
| −1.2544 | .1256 | .2607 |
| −∞ | .1259 | .2709 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .0624 | .2758 |
| −.0091 | .0618 | .2730 |
| −.0191 | .0613 | .2699 |
| −.0284 | .0608 | .2672 |
| −.0376 | .0605 | .2645 |
| −.0471 | .0601 | .2618 |
| −.0565 | .0598 | .2592 |
| −.0657 | .0596 | .2568 |
| −.0747 | .0594 | .2545 |
| −.0841 | .0593 | .2522 |
| −.0933 | .0592 | .2500 |
| −.1023 | .0591 | .2479 |
| −.1117 | .0591 | .2459 |
| −.1209 | .0592 | .2440 |
| −.1305 | .0592 | .2422 |
| −.1398 | .0593 | .2406 |
| −.1498 | .0595 | .2389 |
| −.1596 | .0596 | .2374 |
| −.1700 | .0598 | .2360 |
| −.1808 | .0601 | .2347 |
| −.1920 | .0603 | .2336 |
| −.2041 | .0606 | .2326 |
| −.2175 | .0609 | .2316 |
| −.2332 | .0613 | .2308 |
| −.2506 | .0616 | .2302 |
| .0000 | .0618 | .2299 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| .0120 | .1757 | .1306 | .3979 |
| .0168 | .1791 | .1288 | .4045 |
| .0220 | .1828 | .1269 | .4115 |
| .0265 | .1862 | .1250 | .4179 |
| .0307 | .1895 | .1233 | .4239 |
| .0348 | .1930 | .1215 | .4299 |
| .0385 | .1964 | .1197 | .4355 |
| .0418 | .1997 | .1180 | .4408 |
| .0446 | .2030 | .1163 | .4457 |
| .0470 | .2063 | .1147 | .4505 |
| .0487 | .2096 | .1131 | .4550 |
| .0498 | .2127 | .1116 | .4591 |
| .0501 | .2160 | .1101 | .4629 |
| .0493 | .2192 | .1087 | .4664 |
| .0472 | .2224 | .1075 | .4697 |
| .0436 | .2255 | .1063 | .4726 |
| .0374 | .2287 | .1052 | .4753 |
| .0284 | .2318 | .1043 | .4775 |
| .0145 | .2349 | .1036 | .4795 |
| −.0068 | .2381 | .1031 | .4813 |
| −.0394 | .2412 | .1030 | .4827 |
| −.0940 | .2443 | .1033 | .4838 |
| −.1977 | .2474 | .1044 | .4848 |
| −.4533 | .2505 | .1070 | .4856 |
| −1.7287 | .2537 | .1141 | .4869 |
| $-\infty$ | .2552 | .3081 | .5079 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .0904 | .1578 | .3313 |
| .0092 | .0930 | .1551 | .3392 |
| .0194 | .0957 | .1521 | .3476 |
| .0289 | .0981 | .1493 | .3549 |
| .0381 | .1003 | .1465 | .3618 |
| .0477 | .1025 | .1435 | .3686 |
| .0572 | .1046 | .1406 | .3749 |
| .0665 | .1065 | .1377 | .3807 |
| .0757 | .1083 | .1349 | .3861 |
| .0852 | .1100 | .1320 | .3914 |
| .0945 | .1116 | .1291 | .3962 |
| .1038 | .1131 | .1262 | .4005 |
| .1133 | .1145 | .1233 | .4047 |
| .1228 | .1159 | .1205 | .4085 |
| .1325 | .1171 | .1177 | .4121 |
| .1421 | .1182 | .1150 | .4152 |
| .1526 | .1193 | .1121 | .4182 |
| .1628 | .1203 | .1094 | .4208 |
| .1738 | .1212 | .1067 | .4232 |
| .1855 | .1221 | .1040 | .4254 |
| .1978 | .1228 | .1015 | .4272 |
| .2115 | .1235 | .0990 | .4287 |
| .2276 | .1241 | .0966 | .4301 |
| .2491 | .1247 | .0944 | .4311 |
| .2904 | .1252 | .0928 | .4318 |
| $-.0001$ | .1254 | .0927 | .4319 |

# tableaux 23

## $\alpha = 1.8$ et $\gamma = 1.67$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9936 | 1.0016 | 1.0069 | 1.0054 |
| .9872 | 1.0029 | 1.0139 | 1.0106 |
| .9809 | 1.0039 | 1.0208 | 1.0153 |
| .9744 | 1.0046 | 1.0277 | 1.0197 |
| .9684 | 1.0050 | 1.0342 | 1.0237 |
| .9622 | 1.0051 | 1.0409 | 1.0273 |
| .9562 | 1.0048 | 1.0474 | 1.0306 |
| .9501 | 1.0043 | 1.0539 | 1.0336 |
| .9442 | 1.0034 | 1.0604 | 1.0363 |
| .9384 | 1.0022 | 1.0667 | 1.0386 |
| .9328 | 1.0008 | 1.0728 | 1.0407 |
| .9272 | .9990 | 1.0790 | 1.0425 |
| .9216 | .9967 | 1.0853 | 1.0440 |
| .9161 | .9942 | 1.0913 | 1.0453 |
| .9107 | .9912 | 1.0974 | 1.0463 |
| .9054 | .9876 | 1.1034 | 1.0471 |
| .9003 | .9836 | 1.1094 | 1.0476 |
| .8951 | .9788 | 1.1154 | 1.0480 |
| .8902 | .9733 | 1.1211 | 1.0481 |
| .8852 | .9666 | 1.1270 | 1.0480 |
| .8802 | .9581 | 1.1329 | 1.0477 |
| .8755 | .9472 | 1.1387 | 1.0472 |
| .8707 | .9308 | 1.1445 | 1.0465 |
| .8661 | .8974 | 1.1502 | 1.0457 |
| .8638 | .4440 | 1.1531 | 1.0452 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | −.3350 |
| 1.0134 | 1.0183 | −.3181 |
| 1.0271 | 1.0370 | −.3010 |
| 1.0407 | 1.0553 | −.2843 |
| 1.0546 | 1.0739 | −.2675 |
| 1.0680 | 1.0916 | −.2516 |
| 1.0818 | 1.1096 | −.2357 |
| 1.0954 | 1.1272 | −.2202 |
| 1.1093 | 1.1450 | −.2046 |
| 1.1230 | 1.1624 | −.1896 |
| 1.1367 | 1.1794 | −.1751 |
| 1.1501 | 1.1960 | −.1610 |
| 1.1638 | 1.2127 | −.1470 |
| 1.1777 | 1.2293 | −.1332 |
| 1.1913 | 1.2454 | −.1199 |
| 1.2050 | 1.2614 | −.1069 |
| 1.2187 | 1.2772 | −.0942 |
| 1.2323 | 1.2926 | −.0819 |
| 1.2461 | 1.3080 | −.0697 |
| 1.2595 | 1.3227 | −.0582 |
| 1.2732 | 1.3375 | −.0468 |
| 1.2870 | 1.3521 | −.0356 |
| 1.3007 | 1.3663 | −.0249 |
| 1.3144 | 1.3803 | −.0145 |
| 1.3281 | 1.3941 | −.0046 |
| 1.3350 | 1.4009 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-.0105$ | .0955 | $-.7420$ | $-1.1680$ | .1975 |
| $-.0121$ | .0912 | $-.7399$ | $-1.1897$ | .1876 |
| $-.0139$ | .0869 | $-.7374$ | $-1.2119$ | .1775 |
| $-.0157$ | .0826 | $-.7346$ | $-1.2339$ | .1677 |
| $-.0177$ | .0783 | $-.7313$ | $-1.2562$ | .1577 |
| $-.0197$ | .0741 | $-.7278$ | $-1.2775$ | .1483 |
| $-.0218$ | .0698 | $-.7239$ | $-1.2992$ | .1389 |
| $-.0240$ | .0656 | $-.7195$ | $-1.3206$ | .1297 |
| $-.0263$ | .0613 | $-.7146$ | $-1.3422$ | .1205 |
| $-.0287$ | .0571 | $-.7092$ | $-1.3634$ | .1116 |
| $-.0312$ | .0530 | $-.7034$ | $-1.3841$ | .1030 |
| $-.0338$ | .0489 | $-.6971$ | $-1.4045$ | .0946 |
| $-.0365$ | .0449 | $-.6902$ | $-1.4249$ | .0864 |
| $-.0394$ | .0408 | $-.6824$ | $-1.4454$ | .0782 |
| $-.0424$ | .0369 | $-.6741$ | $-1.4653$ | .0704 |
| $-.0456$ | .0330 | $-.6650$ | $-1.4850$ | .0627 |
| $-.0491$ | .0291 | $-.6549$ | $-1.5046$ | .0552 |
| $-.0528$ | .0254 | $-.6439$ | $-1.5238$ | .0480 |
| $-.0569$ | .0216 | $-.6315$ | $-1.5430$ | .0409 |
| $-.0614$ | .0181 | $-.6181$ | $-1.5615$ | .0341 |
| $-.0667$ | .0145 | $-.6026$ | $-1.5801$ | .0275 |
| $-.0729$ | .0110 | $-.5848$ | $-1.5987$ | .0209 |
| $-.0806$ | .0077 | $-.5642$ | $-1.6167$ | .0147 |
| $-.0914$ | .0045 | $-.5389$ | $-1.6346$ | .0087 |
| $-.1118$ | .0015 | $-.5054$ | $-1.6523$ | .0028 |
| .0000 | .0000 | $-.8831$ | $-1.6611$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1368 | $-.7420$ | $-1.1345$ |
| .0144 | $-.0039$ | .1299 | $-.7351$ | $-1.1448$ |
| .0296 | $-.0077$ | .1229 | $-.7279$ | $-1.1546$ |
| .0453 | $-.0114$ | .1162 | $-.7205$ | $-1.1637$ |
| .0620 | $-.0151$ | .1094 | $-.7126$ | $-1.1723$ |
| .0786 | $-.0187$ | .1030 | $-.7048$ | $-1.1800$ |
| .0962 | $-.0222$ | .0966 | $-.6965$ | $-1.1873$ |
| .1144 | $-.0257$ | .0905 | $-.6880$ | $-1.1940$ |
| .1338 | $-.0292$ | .0843 | $-.6789$ | $-1.2002$ |
| .1538 | $-.0326$ | .0782 | $-.6697$ | $-1.2058$ |
| .1746 | $-.0360$ | .0724 | $-.6601$ | $-1.2109$ |
| .1962 | $-.0394$ | .0668 | $-.6503$ | $-1.2155$ |
| .2193 | $-.0428$ | .0611 | $-.6399$ | $-1.2197$ |
| .2441 | $-.0463$ | .0555 | $-.6289$ | $-1.2234$ |
| .2700 | $-.0499$ | .0501 | .6176 | $-1.2267$ |
| .2980 | $-.0536$ | .0448 | $-.6056$ | $-1.2296$ |
| .3282 | $-.0574$ | .0396 | $-.5930$ | $-1.2321$ |
| .3610 | $-.0614$ | .0345 | $-.5796$ | $-1.2342$ |
| .3978 | $-.0658$ | .0295 | $-.5653$ | $-1.2359$ |
| .4379 | $-.0704$ | .0247 | $-.5502$ | $-1.2373$ |
| .4853 | $-.0757$ | .0199 | $-.5334$ | $-1.2383$ |
| .5424 | $-.0819$ | .0152 | $-.5148$ | $-1.2391$ |
| .6135 | $-.0894$ | .0107 | $-.4940$ | $-1.2395$ |
| .7155 | $-.1000$ | .0063 | $-.4692$ | $-1.2396$ |
| .9140 | $-.1200$ | .0021 | $-.4377$ | $-1.2395$ |
| 4.6848 | .0000 | .0000 | $-.7628$ | $-1.2393$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-3.2385$ | $-.5612$ | .5473 |
| $-3.2393$ | $-.5690$ | .5435 |
| $-3.2372$ | $-.5766$ | .5412 |
| $-3.2321$ | $-.5839$ | .5405 |
| $-3.2239$ | $-.5912$ | .5414 |
| $-3.2132$ | $-.5981$ | .5436 |
| $-3.1994$ | $-.6049$ | .5473 |
| $-3.1828$ | $-.6116$ | .5523 |
| $-3.1628$ | $-.6184$ | .5587 |
| $-3.1399$ | $-.6250$ | .5664 |
| $-3.1138$ | $-.6316$ | .5753 |
| $-3.0846$ | $-.6380$ | .5852 |
| $-3.0511$ | $-.6446$ | .5965 |
| $-3.0126$ | $-.6513$ | .6092 |
| $-2.9697$ | $-.6579$ | .6228 |
| $-2.9205$ | $-.6646$ | .6376 |
| $-2.8638$ | $-.6714$ | .6536 |
| $-2.7980$ | $-.6782$ | .6706 |
| $-2.7186$ | $-.6852$ | .6889 |
| $-2.6237$ | $-.6922$ | .7078 |
| $-2.4991$ | $-.6994$ | .7281 |
| $-2.3256$ | $-.7068$ | .7495 |
| $-2.0593$ | $-.7142$ | .7713 |
| $-1.5255$ | $-.7218$ | .7938 |
| .6681 | $-.7296$ | .8157 |
| $+\infty$ | $-.7336$ | .7935 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-3.3076$ | $-.8331$ | .3276 | $-.1667$ |
| $-3.2912$ | $-.8112$ | .3495 | $-.1586$ |
| $-3.2739$ | $-.7894$ | .3704 | $-.1506$ |
| $-3.2561$ | $-.7682$ | .3899 | $-.1427$ |
| $-3.2371$ | $-.7469$ | .4084 | $-.1347$ |
| $-3.2181$ | $-.7267$ | .4251 | $-.1272$ |
| $-3.1978$ | $-.7064$ | .4411 | $-.1197$ |
| $-3.1768$ | $-.6864$ | .4559 | $-.1125$ |
| $-3.1543$ | $-.6662$ | .4699 | $-.1052$ |
| $-3.1309$ | $-.6464$ | .4828 | $-.0982$ |
| $-3.1066$ | $-.6269$ | .4946 | $-.0914$ |
| $-3.0813$ | $-.6077$ | .5053 | $-.0849$ |
| $-3.0541$ | $-.5883$ | .5153 | $-.0784$ |
| $-3.0249$ | $-.5687$ | .5245 | $-.0720$ |
| $-2.9942$ | $-.5494$ | .5327 | $-.0658$ |
| $-2.9610$ | $-.5301$ | .5401 | $-.0596$ |
| $-2.9250$ | $-.5106$ | .5466 | $-.0536$ |
| $-2.8857$ | $-.4913$ | .5522 | $-.0477$ |
| $-2.8417$ | $-.4717$ | .5571 | $-.0418$ |
| $-2.7933$ | $-.4526$ | .5609 | $-.0361$ |
| $-2.7358$ | $-.4329$ | .5640 | $-.0302$ |
| $-2.6661$ | $-.4130$ | .5663 | $-.0242$ |
| $-2.5784$ | $-.3933$ | .5677 | $-.0181$ |
| $-2.4512$ | $-.3732$ | .5681 | $-.0116$ |
| $-2.2018$ | $-.3531$ | .5677 | $-.0045$ |
| .0000 | $-.3429$ | .5671 | .0000 |

**Ecoulement d'ordre 2
effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| .0284 | .1705 | .3982 |
| .0149 | .1680 | .3927 |
| .0012 | .1657 | .3874 |
| −.0121 | .1637 | .3824 |
| −.0256 | .1619 | .3777 |
| −.0384 | .1604 | .3733 |
| −.0514 | .1590 | .3691 |
| −.0642 | .1579 | .3651 |
| −.0774 | .1568 | .3613 |
| −.0904 | .1560 | .3577 |
| −.1034 | .1553 | .3543 |
| −.1164 | .1548 | .3511 |
| −.1299 | .1544 | .3481 |
| −.1439 | .1541 | .3451 |
| −.1583 | .1539 | .3424 |
| −.1734 | .1539 | .3399 |
| −.1895 | .1540 | .3375 |
| −.2069 | .1541 | .3353 |
| −.2266 | .1544 | .3332 |
| −.2487 | .1548 | .3314 |
| −.2762 | .1552 | .3298 |
| −.3129 | .1558 | .3284 |
| −.3673 | .1564 | .3272 |
| −.4751 | .1572 | .3265 |
| −.9264 | .1580 | .3263 |
| −∞ | .1585 | .3336 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .0730 | .3077 |
| −.0094 | .0721 | .3051 |
| −.0190 | .0713 | .3025 |
| −.0285 | .0707 | .3000 |
| −.0381 | .0701 | .2974 |
| −.0473 | .0696 | .2949 |
| −.0566 | .0692 | .2923 |
| −.0659 | .0690 | .2899 |
| −.0753 | .0687 | .2873 |
| −.0847 | .0686 | .2849 |
| −.0939 | .0686 | .2825 |
| −.1032 | .0686 | .2802 |
| −.1126 | .0687 | .2778 |
| −.1223 | .0688 | .2755 |
| −.1320 | .0690 | .2733 |
| −.1419 | .0693 | .2711 |
| −.1521 | .0696 | .2690 |
| −.1627 | .0700 | .2669 |
| −.1738 | .0704 | .2649 |
| −.1853 | .0708 | .2630 |
| −.1979 | .0713 | .2611 |
| −.2120 | .0719 | .2594 |
| −.2281 | .0725 | .2577 |
| −.2486 | .0731 | .2562 |
| −.2810 | .0738 | .2548 |
| .0000 | .0741 | .2543 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| .0265 | .1768 | .1279 | .4182 |
| .0329 | .1826 | .1278 | .4302 |
| .0392 | .1885 | .1278 | .4421 |
| .0452 | .1944 | .1279 | .4537 |
| .0512 | .2003 | .1281 | .4653 |
| .0567 | .2060 | .1283 | .4761 |
| .0621 | .2118 | .1286 | .4869 |
| .0672 | .2175 | .1291 | .4972 |
| .0721 | .2233 | .1296 | .5074 |
| .0766 | .2291 | .1303 | .5171 |
| .0807 | .2347 | .1310 | .5263 |
| .0843 | .2403 | .1319 | .5351 |
| .0875 | .2460 | .1330 | .5436 |
| .0901 | .2517 | .1342 | .5518 |
| .0919 | .2574 | .1357 | .5595 |
| .0928 | .2631 | .1373 | .5667 |
| .0923 | .2687 | .1392 | .5736 |
| .0899 | .2744 | .1414 | .5799 |
| .0848 | .2802 | .1440 | .5859 |
| .0756 | .2858 | .1470 | .5912 |
| .0591 | .2916 | .1508 | .5962 |
| .0286 | .2975 | .1554 | .6008 |
| −.0316 | .3033 | .1614 | .6048 |
| −.1855 | .3092 | .1702 | .6085 |
| −.9920 | .3153 | .1867 | .6122 |
| −∞ | .3184 | .3850 | .6281 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .0868 | .1477 | .3338 |
| .0095 | .0912 | .1470 | .3456 |
| .0192 | .0954 | .1461 | .3570 |
| .0287 | .0994 | .1453 | .3677 |
| .0383 | .1033 | .1445 | .3780 |
| .0476 | .1068 | .1437 | .3873 |
| .0570 | .1102 | .1430 | .3962 |
| .0663 | .1134 | .1422 | .4045 |
| .0758 | .1165 | .1415 | .4125 |
| .0852 | .1194 | .1408 | .4198 |
| .0945 | .1222 | .1401 | .4266 |
| .1038 | .1247 | .1395 | .4329 |
| .1133 | .1272 | .1390 | .4388 |
| .1231 | .1295 | .1385 | .4444 |
| .1329 | .1317 | .1381 | .4494 |
| .1430 | .1338 | .1378 | .4541 |
| .1533 | .1358 | .1376 | .4583 |
| .1640 | .1376 | .1375 | .4622 |
| .1754 | .1394 | .1376 | .4657 |
| .1871 | .1410 | .1378 | .4688 |
| .2002 | .1426 | .1383 | .4716 |
| .2148 | .1441 | .1391 | .4740 |
| .2317 | .1455 | .1404 | .4761 |
| .2535 | .1469 | .1426 | .4777 |
| .2892 | .1482 | .1470 | .4790 |
| .0000 | .1488 | .1476 | .4795 |

# tableaux 24

## $\alpha = 2$ et $\gamma = 1.33$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|---|---|---|---|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9969 | 1.0026 | 1.0036 | 1.0035 |
| .9937 | 1.0051 | 1.0071 | 1.0068 |
| .9906 | 1.0075 | 1.0106 | 1.0100 |
| .9875 | 1.0097 | 1.0141 | 1.0129 |
| .9844 | 1.0118 | 1.0176 | 1.0158 |
| .9814 | 1.0138 | 1.0210 | 1.0184 |
| .9783 | 1.0157 | 1.0244 | 1.0209 |
| .9753 | 1.0174 | 1.0278 | 1.0232 |
| .9722 | 1.0191 | 1.0312 | 1.0254 |
| .9692 | 1.0206 | 1.0345 | 1.0274 |
| .9663 | 1.0220 | 1.0378 | 1.0293 |
| .9633 | 1.0233 | 1.0411 | 1.0310 |
| .9604 | 1.0244 | 1.0444 | 1.0326 |
| .9574 | 1.0255 | 1.0477 | 1.0341 |
| .9545 | 1.0265 | 1.0509 | 1.0354 |
| .9516 | 1.0273 | 1.0542 | 1.0365 |
| .9488 | 1.0281 | 1.0574 | 1.0376 |
| .9459 | 1.0288 | 1.0606 | 1.0385 |
| .9431 | 1.0293 | 1.0638 | 1.0392 |
| .9403 | 1.0298 | 1.0669 | 1.0398 |
| .9375 | 1.0302 | 1.0701 | 1.0403 |
| .9348 | 1.0305 | 1.0733 | 1.0407 |
| .9321 | 1.0306 | 1.0764 | 1.0410 |
| .9293 | 1.0307 | 1.0795 | 1.0411 |
| .9280 | 1.0307 | 1.0811 | 1.0411 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | $-.1650$ |
| 1.0067 | 1.0098 | $-.1577$ |
| 1.0135 | 1.0195 | $-.1504$ |
| 1.0202 | 1.0292 | $-.1432$ |
| 1.0269 | 1.0387 | $-.1360$ |
| 1.0337 | 1.0482 | $-.1288$ |
| 1.0404 | 1.0575 | $-.1217$ |
| 1.0471 | 1.0667 | $-.1146$ |
| 1.0538 | 1.0758 | $-.1076$ |
| 1.0606 | 1.0848 | $-.1006$ |
| 1.0673 | 1.0937 | $-.0936$ |
| 1.0741 | 1.1025 | $-.0868$ |
| 1.0808 | 1.1111 | $-.0800$ |
| 1.0875 | 1.1196 | $-.0732$ |
| 1.0943 | 1.1281 | $-.0665$ |
| 1.1010 | 1.1364 | $-.0598$ |
| 1.1077 | 1.1446 | $-.0533$ |
| 1.1145 | 1.1526 | $-.0468$ |
| 1.1212 | 1.1606 | $-.0403$ |
| 1.1279 | 1.1684 | $-.0339$ |
| 1.1347 | 1.1760 | $-.0276$ |
| 1.1414 | 1.1836 | $-.0214$ |
| 1.1481 | 1.1910 | $-.0152$ |
| 1.1549 | 1.1983 | $-.0091$ |
| 1.1616 | 1.2054 | $-.0030$ |
| 1.1650 | 1.2089 | $.0000$ |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-.0197$ | .0341 | $-.6116$ | $-1.0827$ | .0910 |
| $-.0204$ | .0325 | $-.6051$ | $-1.0920$ | .0868 |
| $-.0211$ | .0309 | $-.5984$ | $-1.1013$ | .0826 |
| $-.0217$ | .0293 | $-.5913$ | $-1.1105$ | .0785 |
| $-.0222$ | .0277 | $-.5838$ | $-1.1196$ | .0744 |
| $-.0227$ | .0261 | $-.5760$ | $-1.1287$ | .0702 |
| $-.0232$ | .0245 | $-.5678$ | $-1.1377$ | .0662 |
| $-.0236$ | .0229 | $-.5592$ | $-1.1466$ | .0621 |
| $-.0240$ | .0214 | $-.5502$ | $-1.1555$ | .0581 |
| $-.0243$ | .0198 | $-.5406$ | $-1.1642$ | .0541 |
| $-.0246$ | .0183 | $-.5306$ | $-1.1729$ | .0502 |
| $-.0249$ | .0168 | $-.5201$ | $-1.1815$ | .0463 |
| $-.0251$ | .0154 | $-.5089$ | $-1.1900$ | .0424 |
| $-.0253$ | .0140 | $-.4971$ | $-1.1984$ | .0387 |
| $-.0255$ | .0126 | $-.4845$ | $-1.2067$ | .0349 |
| $-.0256$ | .0112 | $-.4711$ | $-1.2149$ | .0313 |
| $-.0257$ | .0099 | $-.4567$ | $-1.2231$ | .0277 |
| $-.0258$ | .0086 | $-.4412$ | $-1.2311$ | .0242 |
| $-.0258$ | .0073 | $-.4242$ | $-1.2391$ | .0207 |
| $-.0258$ | .0062 | $-.4057$ | $-1.2470$ | .0174 |
| $-.0257$ | .0050 | $-.3851$ | $-1.2548$ | .0141 |
| $-.0257$ | .0039 | $-.3616$ | $-1.2625$ | .0110 |
| $-.0255$ | .0029 | $-.3341$ | $-1.2702$ | .0079 |
| $-.0253$ | .0020 | $-.2995$ | $-1.2778$ | .0049 |
| $-.0251$ | .0012 | $-.2485$ | $-1.2853$ | .0021 |
| $-.0250$ | .0009 | $-.1852$ | $-1.2890$ | .0008 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0604 | −.6116 | −1.0565 |
| .0118 | −.0024 | .0574 | −.6032 | −1.0613 |
| .0240 | −.0047 | .0544 | −.5946 | −1.0658 |
| .0366 | −.0069 | .0515 | −.5857 | −1.0701 |
| .0496 | −.0089 | .0486 | −.5765 | −1.0741 |
| .0632 | −.0108 | .0458 | −.5670 | −1.0779 |
| .0771 | −.0125 | .0430 | −.5572 | −1.0814 |
| .0916 | −.0141 | .0403 | −.5471 | −1.0847 |
| .1067 | −.0156 | .0376 | −.5366 | −1.0878 |
| .1224 | −.0170 | .0350 | −.5256 | −1.0906 |
| .1388 | −.0182 | .0324 | −.5143 | −1.0933 |
| .1560 | −.0194 | .0299 | −.5025 | −1.0957 |
| .1740 | −.0204 | .0274 | −.4903 | −1.0979 |
| .1931 | −.0214 | .0249 | −.4774 | −1.0999 |
| .2134 | −.0222 | .0225 | −.4638 | −1.1017 |
| .2349 | −.0230 | .0202 | −.4496 | −1.1033 |
| .2581 | −.0236 | .0179 | −.4346 | −1.1047 |
| .2832 | −.0241 | .0156 | −.4186 | −1.1060 |
| .3108 | −.0246 | .0134 | −.4013 | −1.1070 |
| .3415 | −.0249 | .0113 | −.3826 | −1.1079 |
| .3764 | −.0252 | .0092 | −.3621 | −1.1087 |
| .4175 | −.0253 | .0072 | −.3391 | −1.1092 |
| .4683 | −.0253 | .0052 | −.3123 | −1.1097 |
| .5386 | −.0253 | .0034 | −.2791 | −1.1099 |
| .6670 | −.0251 | .0016 | −.2309 | −1.1101 |
| 1.0630 | −.0250 | .0009 | −.1719 | −1.1101 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| −5.8854 | −.5629 | .5171 |
| −5.8686 | −.5644 | .5103 |
| −5.8527 | −.5657 | .5046 |
| −5.8376 | −.5670 | .5001 |
| −5.8232 | −.5683 | .4967 |
| −5.8094 | −.5695 | .4943 |
| −5.7964 | −.5707 | .4930 |
| −5.7839 | −.5719 | .4926 |
| −5.7719 | −.5731 | .4932 |
| −5.7604 | −.5742 | .4948 |
| −5.7494 | −.5754 | .4974 |
| −5.7388 | −.5766 | .5008 |
| −5.7285 | −.5778 | .5052 |
| −5.7186 | −.5789 | .5104 |
| −5.7089 | −.5802 | .5166 |
| −5.6996 | −.5814 | .5237 |
| −5.6905 | −.5827 | .5316 |
| −5.6816 | −.5839 | .5405 |
| −5.6729 | −.5853 | .5503 |
| −5.6643 | −.5866 | .5609 |
| −5.6559 | −.5880 | .5725 |
| −5.6477 | −.5895 | .5849 |
| −5.6395 | −.5910 | .5983 |
| −5.6313 | −.5925 | .6127 |
| −5.6233 | −.5941 | .6279 |
| −5.6193 | −.5949 | .6358 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −6.0606 | −.7959 | .2841 | −.0673 |
| −6.0195 | −.7721 | .3062 | −.0691 |
| −5.9812 | −.7488 | .3271 | −.0699 |
| −5.9453 | −.7257 | .3471 | −.0699 |
| −5.9119 | −.7030 | .3660 | −.0692 |
| −5.8806 | −.6805 | .3840 | −.0678 |
| −5.8516 | −.6584 | .4009 | −.0658 |
| −5.8247 | −.6364 | .4168 | −.0633 |
| −5.7998 | −.6147 | .4318 | −.0603 |
| −5.7767 | −.5931 | .4459 | −.0569 |
| −5.7555 | −.5717 | .4590 | −.0532 |
| −5.7361 | −.5505 | .4712 | −.0492 |
| −5.7183 | −.5294 | .4824 | −.0449 |
| −5.7022 | −.5084 | .4928 | −.0404 |
| −5.6875 | −.4873 | .5022 | −.0357 |
| −5.6745 | −.4664 | .5108 | −.0309 |
| −5.6630 | −.4456 | .5184 | −.0260 |
| −5.6528 | −.4248 | .5252 | −.0211 |
| −5.6441 | −.4039 | .5310 | −.0160 |
| −5.6367 | −.3831 | .5360 | −.0110 |
| −5.6307 | −.3623 | .5401 | −.0060 |
| −5.6259 | −.3414 | .5433 | −.0010 |
| −5.6225 | −.3205 | .5457 | .0039 |
| −5.6203 | −.2994 | .5471 | .0088 |
| −5.6193 | −.2784 | .5477 | .0135 |
| −5.6193 | −.2679 | .5476 | .0158 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|:-----------:|:--------:|:--------:|
| .0392 | .1039 | .2908 |
| .0306 | .1038 | .2865 |
| .0219 | .1037 | .2824 |
| .0132 | .1037 | .2784 |
| .0044 | .1037 | .2747 |
| −.0045 | .1038 | .2712 |
| −.0135 | .1039 | .2679 |
| −.0226 | .1040 | .2648 |
| −.0318 | .1042 | .2619 |
| −.0413 | .1045 | .2592 |
| −.0509 | .1048 | .2568 |
| −.0607 | .1051 | .2545 |
| −.0708 | .1055 | .2525 |
| −.0812 | .1059 | .2507 |
| −.0920 | .1064 | .2491 |
| −.1033 | .1069 | .2477 |
| −.1151 | .1075 | .2466 |
| −.1276 | .1081 | .2458 |
| −.1411 | .1087 | .2452 |
| −.1557 | .1094 | .2450 |
| −.1720 | .1102 | .2450 |
| −.1906 | .1110 | .2454 |
| −.2131 | .1119 | .2462 |
| −.2432 | .1128 | .2475 |
| −.2966 | .1138 | .2494 |
| −.4505 | .1144 | .2508 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .0422 | .2241 |
| −.0064 | .0430 | .2223 |
| −.0129 | .0439 | .2206 |
| −.0196 | .0447 | .2190 |
| −.0264 | .0456 | .2174 |
| −.0333 | .0464 | .2160 |
| −.0404 | .0473 | .2147 |
| −.0477 | .0481 | .2134 |
| −.0552 | .0490 | .2123 |
| −.0629 | .0498 | .2113 |
| −.0709 | .0507 | .2103 |
| −.0791 | .0515 | .2096 |
| −.0876 | .0524 | .2089 |
| −.0965 | .0533 | .2084 |
| −.1058 | .0542 | .2079 |
| −.1156 | .0551 | .2077 |
| −.1260 | .0561 | .2076 |
| −.1372 | .0570 | .2077 |
| −.1493 | .0580 | .2079 |
| −.1626 | .0589 | .2083 |
| −.1775 | .0599 | .2090 |
| −.1949 | .0609 | .2099 |
| −.2161 | .0620 | .2111 |
| −.2451 | .0630 | .2126 |
| −.2972 | .0641 | .2146 |
| −.4505 | .0647 | .2160 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| .0843 | .2285 | .1771 | .4795 |
| .0824 | .2302 | .1755 | .4752 |
| .0809 | .2320 | .1738 | .4710 |
| .0798 | .2338 | .1720 | .4669 |
| .0789 | .2358 | .1701 | .4627 |
| .0784 | .2378 | .1681 | .4586 |
| .0782 | .2399 | .1660 | .4544 |
| .0784 | .2420 | .1638 | .4503 |
| .0789 | .2442 | .1615 | .4462 |
| .0797 | .2465 | .1591 | .4420 |
| .0810 | .2488 | .1565 | .4379 |
| .0826 | .2511 | .1539 | .4337 |
| .0847 | .2535 | .1510 | .4295 |
| .0873 | .2559 | .1481 | .4253 |
| .0904 | .2583 | .1449 | .4211 |
| .0942 | .2608 | .1416 | .4168 |
| .0986 | .2633 | .1381 | .4125 |
| .1039 | .2658 | .1344 | .4082 |
| .1103 | .2684 | .1304 | .4039 |
| .1180 | .2709 | .1261 | .3996 |
| .1274 | .2734 | .1216 | .3952 |
| .1394 | .2760 | .1166 | .3908 |
| .1553 | .2785 | .1112 | .3864 |
| .1791 | .2811 | .1050 | .3821 |
| .2263 | .2836 | .0985 | .3777 |
| .3773 | .2848 | .1212 | .3756 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1068 | .2073 | .3529 |
| .0014 | .1079 | .2052 | .3513 |
| .0032 | .1089 | .2030 | .3497 |
| .0052 | .1100 | .2006 | .3481 |
| .0075 | .1110 | .1981 | .3465 |
| .0102 | .1120 | .1954 | .3450 |
| .0133 | .1131 | .1925 | .3434 |
| .0166 | .1140 | .1896 | .3419 |
| .0203 | .1150 | .1864 | .3404 |
| .0244 | .1160 | .1831 | .3390 |
| .0289 | .1169 | .1796 | .3375 |
| .0339 | .1178 | .1759 | .3361 |
| .0393 | .1186 | .1721 | .3348 |
| .0452 | .1194 | .1680 | .3334 |
| .0517 | .1202 | .1637 | .3322 |
| .0589 | .1210 | .1593 | .3309 |
| .0668 | .1216 | .1545 | .3298 |
| .0756 | .1223 | .1495 | .3287 |
| .0856 | .1229 | .1441 | .3277 |
| .0969 | .1234 | .1383 | .3267 |
| .1100 | .1239 | .1321 | .3259 |
| .1257 | .1243 | .1254 | .3251 |
| .1455 | .1246 | .1179 | .3244 |
| .1732 | .1248 | .1093 | .3239 |
| .2243 | .1250 | .0993 | .3236 |
| .3773 | .1250 | .1164 | .3235 |

# tableaux 25

## $\alpha = 2$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|---|---|---|---|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9962 | 1.0031 | 1.0044 | 1.0043 |
| .9925 | 1.0059 | 1.0087 | 1.0083 |
| .9888 | 1.0087 | 1.0130 | 1.0122 |
| .9851 | 1.0113 | 1.0172 | 1.0158 |
| .9814 | 1.0137 | 1.0214 | 1.0192 |
| .9777 | 1.0160 | 1.0256 | 1.0224 |
| .9741 | 1.0181 | 1.0297 | 1.0254 |
| .9705 | 1.0201 | 1.0338 | 1.0283 |
| .9669 | 1.0220 | 1.0379 | 1.0309 |
| .9633 | 1.0237 | 1.0419 | 1.0333 |
| .9598 | 1.0253 | 1.0459 | 1.0356 |
| .9563 | 1.0268 | 1.0499 | 1.0377 |
| .9528 | 1.0281 | 1.0539 | 1.0396 |
| .9493 | 1.0293 | 1.0578 | 1.0413 |
| .9459 | 1.0304 | 1.0617 | 1.0429 |
| .9425 | 1.0314 | 1.0656 | 1.0442 |
| .9392 | 1.0323 | 1.0695 | 1.0455 |
| .9358 | 1.0330 | 1.0733 | 1.0465 |
| .9325 | 1.0337 | 1.0772 | 1.0474 |
| .9293 | 1.0342 | 1.0810 | 1.0482 |
| .9260 | 1.0346 | 1.0848 | 1.0488 |
| .9228 | 1.0349 | 1.0885 | 1.0492 |
| .9196 | 1.0351 | 1.0923 | 1.0495 |
| .9165 | 1.0352 | 1.0960 | 1.0497 |
| .9149 | 1.0352 | 1.0979 | 1.0497 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0082 | 1.0119 | $-.1910$ |
| 1.0163 | 1.0236 | $-.1820$ |
| 1.0245 | 1.0353 | $-.1731$ |
| 1.0326 | 1.0468 | $-.1643$ |
| 1.0408 | 1.0583 | $-.1554$ |
| 1.0490 | 1.0696 | $-.1467$ |
| 1.0571 | 1.0807 | $-.1380$ |
| 1.0653 | 1.0918 | $-.1294$ |
| 1.0735 | 1.1028 | $-.1209$ |
| 1.0816 | 1.1135 | $-.1125$ |
| 1.0898 | 1.1242 | $-.1041$ |
| 1.0979 | 1.1347 | $-.0958$ |
| 1.1061 | 1.1451 | $-.0877$ |
| 1.1143 | 1.1554 | $-.0795$ |
| 1.1224 | 1.1655 | $-.0715$ |
| 1.1306 | 1.1755 | $-.0636$ |
| 1.1387 | 1.1853 | $-.0558$ |
| 1.1469 | 1.1950 | $-.0480$ |
| 1.1551 | 1.2045 | $-.0404$ |
| 1.1632 | 1.2138 | $-.0328$ |
| 1.1714 | 1.2230 | $-.0254$ |
| 1.1795 | 1.2320 | $-.0180$ |
| 1.1877 | 1.2410 | $-.0107$ |
| 1.1959 | 1.2496 | $-.0036$ |
| 1.2000 | 1.2540 | $.0000$ |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| −.0225 | .0428 | −.6347 | −1.0983 | .1121 |
| −.0233 | .0408 | −.6291 | −1.1097 | .1070 |
| −.0240 | .0389 | −.6232 | −1.1210 | .1018 |
| −.0246 | .0369 | −.6170 | −1.1323 | .0967 |
| −.0252 | .0349 | −.6104 | −1.1436 | .0916 |
| −.0257 | .0330 | −.6034 | −1.1548 | .0865 |
| −.0262 | .0310 | −.5961 | −1.1658 | .0814 |
| −.0266 | .0291 | −.5883 | −1.1768 | .0764 |
| −.0270 | .0272 | −.5801 | −1.1877 | .0714 |
| −.0273 | .0253 | −.5714 | −1.1986 | .0665 |
| −.0276 | .0234 | −.5621 | −1.2093 | .0616 |
| −.0278 | .0216 | −.5524 | −1.2198 | .0568 |
| −.0280 | .0197 | −.5420 | −1.2303 | .0521 |
| −.0282 | .0180 | −.5309 | −1.2407 | .0474 |
| −.0283 | .0162 | −.5190 | −1.2511 | .0428 |
| −.0284 | .0145 | −.5063 | −1.2613 | .0383 |
| −.0284 | .0128 | −.4926 | −1.2713 | .0339 |
| −.0284 | .0112 | −.4777 | −1.2813 | .0296 |
| −.0284 | .0096 | −.4614 | −1.2912 | .0254 |
| −.0283 | .0081 | −.4435 | −1.3010 | .0213 |
| −.0282 | .0066 | −.4235 | −1.3106 | .0173 |
| −.0280 | .0052 | −.4007 | −1.3202 | .0134 |
| −.0278 | .0039 | −.3737 | −1.3296 | .0097 |
| −.0275 | .0027 | −.3396 | −1.3390 | .0060 |
| −.0272 | .0016 | −.2890 | −1.3483 | .0026 |
| −.0271 | .0012 | −.2210 | −1.3530 | .0010 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0743 | $-.6347$ | $-1.0668$ |
| .0121 | $-.0028$ | .0706 | $-.6267$ | $-1.0727$ |
| .0247 | $-.0054$ | .0669 | $-.6185$ | $-1.0783$ |
| .0376 | $-.0079$ | .0634 | $-.6101$ | $-1.0835$ |
| .0511 | $-.0101$ | .0599 | $-.6013$ | $-1.0885$ |
| .0651 | $-.0122$ | .0564 | $-.5922$ | $-1.0931$ |
| .0795 | $-.0142$ | .0530 | $-.5828$ | $-1.0975$ |
| .0945 | $-.0159$ | .0497 | $-.5731$ | $-1.1015$ |
| .1102 | $-.0176$ | .0464 | $-.5630$ | $-1.1053$ |
| .1266 | $-.0190$ | .0431 | $-.5524$ | $-1.1088$ |
| .1436 | $-.0204$ | .0400 | $-.5415$ | $-1.1120$ |
| .1615 | $-.0216$ | .0368 | $-.5302$ | $-1.1149$ |
| .1804 | $-.0227$ | .0338 | $-.5183$ | $-1.1176$ |
| .2003 | $-.0237$ | .0308 | $-.5058$ | $-1.1201$ |
| .2217 | $-.0246$ | .0278 | $-.4927$ | $-1.1223$ |
| .2443 | $-.0254$ | .0249 | $-.4789$ | $-1.1243$ |
| .2687 | $-.0260$ | .0221 | $-.4643$ | $-1.1260$ |
| .2952 | $-.0266$ | .0194 | $-.4487$ | $-1.1275$ |
| .3246 | $-.0270$ | .0166 | $-.4318$ | $-1.1288$ |
| .3573 | $-.0273$ | .0140 | $-.4136$ | $-1.1299$ |
| .3946 | $-.0275$ | .0114 | $-.3936$ | $-1.1308$ |
| .4388 | $-.0276$ | .0090 | $-.3711$ | $-1.1315$ |
| .4939 | $-.0276$ | .0066 | $-.3449$ | $-1.1320$ |
| .5709 | $-.0275$ | .0042 | $-.3123$ | $-1.1324$ |
| .7142 | $-.0272$ | .0021 | $-.2649$ | $-1.1326$ |
| 1.1543 | $-.0271$ | .0011 | $-.2022$ | $-1.1326$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-4.8279$ | $-.5525$ | .5112 |
| $-4.8105$ | $-.5542$ | .5043 |
| $-4.7941$ | $-.5559$ | .4987 |
| $-4.7787$ | $-.5574$ | .4943 |
| $-4.7642$ | $-.5589$ | .4911 |
| $-4.7504$ | $-.5604$ | .4890 |
| $-4.7374$ | $-.5619$ | .4879 |
| $-4.7250$ | $-.5633$ | .4879 |
| $-4.7133$ | $-.5647$ | .4888 |
| $-4.7020$ | $-.5661$ | .4908 |
| $-4.6914$ | $-.5675$ | .4937 |
| $-4.6812$ | $-.5690$ | .4976 |
| $-4.6713$ | $-.5704$ | .5024 |
| $-4.6619$ | $-.5718$ | .5081 |
| $-4.6527$ | $-.5733$ | .5148 |
| $-4.6439$ | $-.5748$ | .5224 |
| $-4.6354$ | $-.5763$ | .5308 |
| $-4.6271$ | $-.5778$ | .5402 |
| $-4.6190$ | $-.5794$ | .5505 |
| $-4.6110$ | $-.5810$ | .5617 |
| $-4.6033$ | $-.5827$ | .5738 |
| $-4.5957$ | $-.5844$ | .5868 |
| $-4.5881$ | $-.5861$ | .6008 |
| $-4.5806$ | $-.5879$ | .6158 |
| $-4.5732$ | $-.5898$ | .6316 |
| $-4.5695$ | $-.5907$ | .6399 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-5.0000$ | $-.7935$ | .2702 | $-.0826$ |
| $-4.9588$ | $-.7690$ | .2926 | $-.0845$ |
| $-4.9205$ | $-.7451$ | .3139 | $-.0853$ |
| $-4.8849$ | $-.7216$ | .3341 | $-.0851$ |
| $-4.8519$ | $-.6985$ | .3532 | $-.0839$ |
| $-4.8210$ | $-.6756$ | .3715 | $-.0820$ |
| $-4.7926$ | $-.6532$ | .3885 | $-.0794$ |
| $-4.7664$ | $-.6310$ | .4046 | $-.0761$ |
| $-4.7421$ | $-.6091$ | .4197 | $-.0724$ |
| $-4.7197$ | $-.5873$ | .4339 | $-.0681$ |
| $-4.6992$ | $-.5658$ | .4471 | $-.0635$ |
| $-4.6805$ | $-.5444$ | .4593 | $-.0585$ |
| $-4.6635$ | $-.5232$ | .4706 | $-.0533$ |
| $-4.6480$ | $-.5021$ | .4810 | $-.0478$ |
| $-4.6340$ | $-.4809$ | .4905 | $-.0422$ |
| $-4.6216$ | $-.4599$ | .4991 | $-.0364$ |
| $-4.6106$ | $-.4390$ | .5067 | $-.0305$ |
| $-4.6010$ | $-.4182$ | .5135 | $-.0246$ |
| $-4.5927$ | $-.3971$ | .5193 | $-.0186$ |
| $-4.5858$ | $-.3763$ | .5243 | $-.0127$ |
| $-4.5801$ | $-.3554$ | .5284 | $-.0068$ |
| $-4.5757$ | $-.3344$ | .5316 | $-.0009$ |
| $-4.5725$ | $-.3134$ | .5339 | .0049 |
| $-4.5704$ | $-.2922$ | .5353 | .0105 |
| $-4.5695$ | $-.2710$ | .5358 | .0161 |
| $-4.5695$ | $-.2603$ | .5357 | .0188 |

**Ecoulement d'ordre 2
effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|:---:|:---:|:---:|
| .0404 | .1128 | .3059 |
| .0319 | .1127 | .3014 |
| .0233 | .1127 | .2972 |
| .0147 | .1128 | .2932 |
| .0059 | .1129 | .2894 |
| −.0029 | .1131 | .2858 |
| −.0119 | .1133 | .2824 |
| −.0209 | .1136 | .2792 |
| −.0301 | .1139 | .2762 |
| −.0396 | .1143 | .2734 |
| −.0492 | .1147 | .2709 |
| −.0591 | .1152 | .2685 |
| −.0692 | .1158 | .2664 |
| −.0797 | .1163 | .2645 |
| −.0907 | .1170 | .2628 |
| −.1021 | .1177 | .2614 |
| −.1141 | .1184 | .2602 |
| −.1268 | .1192 | .2593 |
| −.1406 | .1201 | .2587 |
| −.1556 | .1210 | .2584 |
| −.1723 | .1220 | .2584 |
| −.1916 | .1231 | .2587 |
| −.2151 | .1242 | .2596 |
| −.2469 | .1254 | .2609 |
| −.3041 | .1267 | .2629 |
| −.5263 | .1274 | .2645 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .0445 | .2316 |
| −.0061 | .0456 | .2299 |
| −.0124 | .0467 | .2282 |
| −.0189 | .0478 | .2267 |
| −.0255 | .0489 | .2252 |
| −.0323 | .0500 | .2238 |
| −.0393 | .0511 | .2225 |
| −.0465 | .0522 | .2212 |
| −.0538 | .0532 | .2200 |
| −.0615 | .0543 | .2189 |
| −.0694 | .0554 | .2180 |
| −.0776 | .0565 | .2171 |
| −.0862 | .0575 | .2163 |
| −.0951 | .0586 | .2156 |
| −.1046 | .0598 | .2151 |
| −.1145 | .0609 | .2147 |
| −.1251 | .0620 | .2144 |
| −.1364 | .0632 | .2143 |
| −.1488 | .0643 | .2144 |
| −.1625 | .0655 | .2146 |
| −.1779 | .0667 | .2151 |
| −.1959 | .0680 | .2158 |
| −.2181 | .0692 | .2168 |
| −.2487 | .0705 | .2182 |
| −.3047 | .0718 | .2200 |
| −.5263 | .0725 | .2214 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|:---:|:---:|:---:|:---:|
| .0809 | .2325 | .1794 | .4879 |
| .0790 | .2346 | .1785 | .4842 |
| .0775 | .2368 | .1776 | .4806 |
| .0763 | .2391 | .1765 | .4770 |
| .0755 | .2415 | .1754 | .4734 |
| .0750 | .2441 | .1741 | .4698 |
| .0749 | .2467 | .1728 | .4662 |
| .0751 | .2494 | .1713 | .4625 |
| .0756 | .2521 | .1697 | .4589 |
| .0765 | .2550 | .1680 | .4552 |
| .0779 | .2579 | .1661 | .4514 |
| .0796 | .2608 | .1641 | .4476 |
| .0818 | .2638 | .1620 | .4438 |
| .0845 | .2669 | .1597 | .4399 |
| .0878 | .2700 | .1572 | .4359 |
| .0917 | .2731 | .1545 | .4319 |
| .0963 | .2763 | .1516 | .4279 |
| .1018 | .2795 | .1485 | .4238 |
| .1084 | .2827 | .1451 | .4195 |
| .1164 | .2859 | .1415 | .4153 |
| .1263 | .2892 | .1374 | .4110 |
| .1388 | .2925 | .1330 | .4066 |
| .1556 | .2957 | .1280 | .4022 |
| .1809 | .2990 | .1223 | .3978 |
| .2319 | .3022 | .1162 | .3934 |
| .4510 | .3038 | .1678 | .3912 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1075 | .2074 | .3568 |
| .0011 | .1087 | .2061 | .3554 |
| .0026 | .1099 | .2047 | .3540 |
| .0044 | .1112 | .2031 | .3525 |
| .0066 | .1124 | .2014 | .3510 |
| .0091 | .1136 | .1994 | .3496 |
| .0119 | .1148 | .1973 | .3481 |
| .0151 | .1160 | .1951 | .3467 |
| .0187 | .1172 | .1927 | .3452 |
| .0228 | .1183 | .1901 | .3438 |
| .0272 | .1194 | .1873 | .3424 |
| .0320 | .1205 | .1843 | .3410 |
| .0374 | .1215 | .1811 | .3396 |
| .0433 | .1225 | .1777 | .3383 |
| .0498 | .1235 | .1741 | .3370 |
| .0570 | .1244 | .1702 | .3357 |
| .0650 | .1253 | .1660 | .3345 |
| .0739 | .1261 | .1616 | .3334 |
| .0840 | .1268 | .1568 | .3323 |
| .0955 | .1275 | .1516 | .3312 |
| .1090 | .1281 | .1459 | .3303 |
| .1252 | .1287 | .1397 | .3294 |
| .1458 | .1291 | .1327 | .3287 |
| .1750 | .1295 | .1246 | .3281 |
| .2299 | .1297 | .1150 | .3276 |
| .4510 | .1297 | .1590 | .3275 |

# tableaux 26

## $\alpha = 2$ et $\gamma = 1.67$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9940 | 1.0044 | 1.0075 | 1.0074 |
| .9880 | 1.0085 | 1.0149 | 1.0143 |
| .9820 | 1.0124 | 1.0222 | 1.0208 |
| .9761 | 1.0160 | 1.0294 | 1.0269 |
| .9702 | 1.0195 | 1.0365 | 1.0327 |
| .9644 | 1.0226 | 1.0435 | 1.0381 |
| .9587 | 1.0256 | 1.0504 | 1.0431 |
| .9531 | 1.0283 | 1.0573 | 1.0477 |
| .9475 | 1.0308 | 1.0641 | 1.0520 |
| .9419 | 1.0332 | 1.0707 | 1.0560 |
| .9365 | 1.0353 | 1.0773 | 1.0597 |
| .9311 | 1.0373 | 1.0839 | 1.0630 |
| .9258 | 1.0391 | 1.0903 | 1.0661 |
| .9206 | 1.0407 | 1.0968 | 1.0689 |
| .9154 | 1.0421 | 1.1031 | 1.0714 |
| .9103 | 1.0434 | 1.1094 | 1.0736 |
| .9053 | 1.0446 | 1.1157 | 1.0755 |
| .9003 | 1.0455 | 1.1219 | 1.0772 |
| .8955 | 1.0464 | 1.1281 | 1.0786 |
| .8907 | 1.0470 | 1.1342 | 1.0798 |
| .8859 | 1.0476 | 1.1403 | 1.0807 |
| .8813 | 1.0480 | 1.1463 | 1.0814 |
| .8767 | 1.0482 | 1.1524 | 1.0818 |
| .8721 | 1.0484 | 1.1583 | 1.0821 |
| .8699 | 1.0484 | 1.1613 | 1.0821 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|---------|
| 1.0000 | 1.0000 | $-.3350$ |
| 1.0137 | 1.0197 | $-.3189$ |
| 1.0273 | 1.0392 | $-.3029$ |
| 1.0410 | 1.0586 | $-.2871$ |
| 1.0546 | 1.0778 | $-.2714$ |
| 1.0684 | 1.0971 | $-.2559$ |
| 1.0820 | 1.1160 | $-.2406$ |
| 1.0957 | 1.1348 | $-.2256$ |
| 1.1093 | 1.1534 | $-.2108$ |
| 1.1231 | 1.1720 | $-.1961$ |
| 1.1367 | 1.1902 | $-.1818$ |
| 1.1504 | 1.2083 | $-.1676$ |
| 1.1640 | 1.2261 | $-.1538$ |
| 1.1777 | 1.2438 | $-.1401$ |
| 1.1914 | 1.2613 | $-.1266$ |
| 1.2051 | 1.2785 | $-.1135$ |
| 1.2187 | 1.2955 | $-.1005$ |
| 1.2324 | 1.3123 | $-.0879$ |
| 1.2461 | 1.3289 | $-.0753$ |
| 1.2598 | 1.3451 | $-.0631$ |
| 1.2734 | 1.3611 | $-.0511$ |
| 1.2871 | 1.3769 | $-.0394$ |
| 1.3007 | 1.3924 | $-.0279$ |
| 1.3145 | 1.4077 | $-.0165$ |
| 1.3281 | 1.4226 | $-.0055$ |
| 1.3349 | 1.4299 | $-.0001$ |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-.0304$ | $.0799$ | $-.7225$ | $-1.1535$ | $.1983$ |
| $-.0314$ | $.0767$ | $-.7207$ | $-1.1732$ | $.1891$ |
| $-.0322$ | $.0734$ | $-.7185$ | $-1.1930$ | $.1798$ |
| $-.0329$ | $.0701$ | $-.7159$ | $-1.2127$ | $.1705$ |
| $-.0335$ | $.0667$ | $-.7130$ | $-1.2325$ | $.1612$ |
| $-.0340$ | $.0633$ | $-.7096$ | $-1.2523$ | $.1519$ |
| $-.0343$ | $.0599$ | $-.7059$ | $-1.2719$ | $.1427$ |
| $-.0345$ | $.0565$ | $-.7017$ | $-1.2914$ | $.1335$ |
| $-.0347$ | $.0531$ | $-.6970$ | $-1.3109$ | $.1245$ |
| $-.0348$ | $.0496$ | $-.6918$ | $-1.3303$ | $.1156$ |
| $-.0349$ | $.0462$ | $-.6860$ | $-1.3495$ | $.1069$ |
| $-.0348$ | $.0428$ | $-.6796$ | $-1.3685$ | $.0983$ |
| $-.0348$ | $.0394$ | $-.6726$ | $-1.3873$ | $.0898$ |
| $-.0347$ | $.0361$ | $-.6649$ | $-1.4060$ | $.0816$ |
| $-.0345$ | $.0328$ | $-.6563$ | $-1.4247$ | $.0735$ |
| $-.0343$ | $.0295$ | $-.6468$ | $-1.4430$ | $.0656$ |
| $-.0340$ | $.0262$ | $-.6363$ | $-1.4612$ | $.0579$ |
| $-.0338$ | $.0230$ | $-.6246$ | $-1.4792$ | $.0504$ |
| $-.0334$ | $.0199$ | $-.6113$ | $-1.4971$ | $.0431$ |
| $-.0331$ | $.0168$ | $-.5964$ | $-1.5147$ | $.0360$ |
| $-.0327$ | $.0138$ | $-.5793$ | $-1.5321$ | $.0292$ |
| $-.0322$ | $.0109$ | $-.5593$ | $-1.5493$ | $.0226$ |
| $-.0318$ | $.0082$ | $-.5351$ | $-1.5663$ | $.0162$ |
| $-.0313$ | $.0055$ | $-.5035$ | $-1.5832$ | $.0101$ |
| $-.0307$ | $.0031$ | $-.4554$ | $-1.5999$ | $.0043$ |
| $-.0304$ | $.0020$ | $-.3931$ | $-1.6081$ | $.0016$ |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1306 | −.7225 | −1.1028 |
| .0133 | −.0040 | .1241 | −.7163 | −1.1132 |
| .0272 | −.0076 | .1177 | −.7098 | −1.1230 |
| .0416 | −.0108 | .1115 | −.7030 | −1.1322 |
| .0566 | −.0137 | .1054 | −.6959 | −1.1409 |
| .0723 | −.0163 | .0993 | −.6885 | −1.1490 |
| .0886 | −.0186 | .0934 | −.6808 | −1.1565 |
| .1056 | −.0207 | .0876 | −.6727 | −1.1636 |
| .1234 | −.0226 | .0819 | −.6643 | −1.1701 |
| .1421 | −.0242 | .0762 | −.6554 | −1.1761 |
| .1618 | −.0257 | .0707 | −.6462 | −1.1816 |
| .1824 | −.0270 | .0653 | −.6365 | −1.1867 |
| .2043 | −.0281 | .0600 | −.6263 | −1.1914 |
| .2276 | −.0290 | .0547 | −.6156 | −1.1956 |
| .2526 | −.0298 | .0496 | −.6041 | −1.1994 |
| .2794 | −.0305 | .0445 | −.5921 | −1.2027 |
| .3085 | −.0310 | .0395 | −.5792 | −1.2057 |
| .3403 | −.0314 | .0347 | −.5654 | −1.2083 |
| .3759 | −.0317 | .0299 | −.5504 | −1.2105 |
| .4159 | −.0318 | .0252 | −.5341 | −1.2124 |
| .4623 | −.0319 | .0206 | −.5160 | −1.2139 |
| .5179 | −.0318 | .0161 | −.4955 | −1.2151 |
| .5887 | −.0315 | .0118 | −.4715 | −1.2160 |
| .6902 | −.0312 | .0076 | −.4414 | −1.2166 |
| .8878 | −.0307 | .0036 | −.3971 | −1.2169 |
| 1.5828 | −.0304 | .0017 | −.3420 | −1.2170 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|:---:|:---:|:---:|
| $-2.8248$ | $-.5184$ | .4950 |
| $-2.8056$ | $-.5211$ | .4878 |
| $-2.7880$ | $-.5237$ | .4823 |
| $-2.7719$ | $-.5263$ | .4782 |
| $-2.7571$ | $-.5287$ | .4756 |
| $-2.7434$ | $-.5311$ | .4743 |
| $-2.7308$ | $-.5335$ | .4742 |
| $-2.7192$ | $-.5358$ | .4753 |
| $-2.7083$ | $-.5381$ | .4775 |
| $-2.6981$ | $-.5404$ | .4808 |
| $-2.6887$ | $-.5427$ | .4852 |
| $-2.6798$ | $-.5450$ | .4905 |
| $-2.6714$ | $-.5473$ | .4969 |
| $-2.6635$ | $-.5497$ | .5042 |
| $-2.6560$ | $-.5520$ | .5126 |
| $-2.6488$ | $-.5544$ | .5219 |
| $-2.6420$ | $-.5567$ | .5321 |
| $-2.6355$ | $-.5591$ | .5434 |
| $-2.6292$ | $-.5616$ | .5556 |
| $-2.6231$ | $-.5640$ | .5687 |
| $-2.6172$ | $-.5665$ | .5828 |
| $-2.6114$ | $-.5691$ | .5979 |
| $-2.6058$ | $-.5716$ | .6139 |
| $-2.6002$ | $-.5743$ | .6311 |
| $-2.5947$ | $-.5769$ | .6492 |
| $-2.5920$ | $-.5782$ | .6585 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −2.9851 | −.7860 | .2273 | −.1434 |
| −2.9435 | −.7592 | .2509 | −.1454 |
| −2.9056 | −.7333 | .2732 | −.1454 |
| −2.8711 | −.7081 | .2942 | −.1436 |
| −2.8395 | −.6837 | .3140 | −.1403 |
| −2.8106 | −.6596 | .3328 | −.1357 |
| −2.7843 | −.6363 | .3504 | −.1301 |
| −2.7604 | −.6133 | .3669 | −.1235 |
| −2.7385 | −.5908 | .3823 | −.1163 |
| −2.7186 | −.5684 | .3968 | −.1084 |
| −2.7005 | −.5464 | .4102 | −.1001 |
| −2.6842 | −.5247 | .4226 | −.0914 |
| −2.6695 | −.5031 | .4340 | −.0824 |
| −2.6563 | −.4817 | .4445 | −.0732 |
| −2.6445 | −.4602 | .4541 | −.0639 |
| −2.6341 | −.4390 | .4627 | −.0545 |
| −2.6249 | −.4178 | .4703 | −.0451 |
| −2.6170 | −.3966 | .4771 | −.0358 |
| −2.6102 | −.3753 | .4829 | −.0266 |
| −2.6046 | −.3541 | .4878 | −.0175 |
| −2.6001 | −.3328 | .4918 | −.0085 |
| −2.5966 | −.3114 | .4949 | .0002 |
| −2.5941 | −.2900 | .4970 | .0087 |
| −2.5925 | −.2683 | .4983 | .0171 |
| −2.5920 | −.2466 | .4986 | .0251 |
| −2.5920 | −.2357 | .4984 | .0290 |

**Ecoulement d'ordre 2**
**effet isotrope du courant**

| $\rho_{23}$ | $u_{23}$ | $p_{23}$ |
|---|---|---|
| .0438 | .1463 | .3625 |
| .0359 | .1470 | .3578 |
| .0278 | .1477 | .3534 |
| .0195 | .1485 | .3493 |
| .0112 | .1494 | .3454 |
| .0026 | .1503 | .3416 |
| −.0061 | .1513 | .3381 |
| −.0150 | .1524 | .3348 |
| −.0241 | .1535 | .3317 |
| −.0335 | .1547 | .3288 |
| −.0432 | .1560 | .3260 |
| −.0531 | .1574 | .3234 |
| −.0635 | .1588 | .3211 |
| −.0742 | .1603 | .3189 |
| −.0855 | .1619 | .3170 |
| −.0974 | .1636 | .3152 |
| −.1100 | .1653 | .3138 |
| −.1235 | .1671 | .3125 |
| −.1382 | .1691 | .3116 |
| −.1544 | .1710 | .3110 |
| −.1727 | .1731 | .3107 |
| −.1941 | .1753 | .3109 |
| −.2205 | .1776 | .3116 |
| −.2574 | .1800 | .3129 |
| −.3265 | .1825 | .3151 |
| −.5536 | .1838 | .3169 |

| $\rho_{23}^*$ | $u_{23}^*$ | $p_{23}^*$ |
|---|---|---|
| .0000 | .0530 | .2588 |
| −.0052 | .0555 | .2577 |
| −.0106 | .0580 | .2565 |
| −.0163 | .0603 | .2553 |
| −.0222 | .0626 | .2541 |
| −.0285 | .0648 | .2529 |
| −.0350 | .0669 | .2516 |
| −.0418 | .0690 | .2503 |
| −.0489 | .0710 | .2490 |
| −.0563 | .0731 | .2477 |
| −.0641 | .0751 | .2464 |
| −.0723 | .0771 | .2451 |
| −.0809 | .0791 | .2439 |
| −.0900 | .0811 | .2427 |
| −.0997 | .0831 | .2416 |
| −.1100 | .0850 | .2406 |
| −.1211 | .0870 | .2396 |
| −.1332 | .0891 | .2387 |
| −.1465 | .0911 | .2380 |
| −.1613 | .0932 | .2375 |
| −.1783 | .0952 | .2371 |
| −.1984 | .0973 | .2369 |
| −.2236 | .0995 | .2371 |
| −.2592 | .1017 | .2376 |
| −.3271 | .1039 | .2388 |
| −.5536 | .1050 | .2398 |

**Ecoulement d'ordre 2**
**effet anisotrope du courant**

| $\rho_{21}$ | $u_{21}$ | $v_2$ | $p_{21}$ |
|---|---|---|---|
| .0691 | .2447 | .1859 | .5155 |
| .0671 | .2484 | .1880 | .5141 |
| .0654 | .2524 | .1901 | .5127 |
| .0643 | .2566 | .1920 | .5114 |
| .0635 | .2610 | .1939 | .5101 |
| .0631 | .2657 | .1956 | .5088 |
| .0631 | .2705 | .1972 | .5073 |
| .0635 | .2755 | .1988 | .5058 |
| .0643 | .2807 | .2001 | .5041 |
| .0655 | .2861 | .2014 | .5023 |
| .0671 | .2916 | .2025 | .5003 |
| .0692 | .2972 | .2034 | .4982 |
| .0718 | .3030 | .2041 | .4958 |
| .0749 | .3088 | .2047 | .4933 |
| .0786 | .3149 | .2050 | .4905 |
| .0829 | .3209 | .2051 | .4875 |
| .0881 | .3271 | .2049 | .4843 |
| .0943 | .3334 | .2043 | .4809 |
| .1017 | .3398 | .2035 | .4772 |
| .1107 | .3462 | .2022 | .4733 |
| .1218 | .3526 | .2004 | .4691 |
| .1361 | .3591 | .1979 | .4647 |
| .1556 | .3657 | .1947 | .4601 |
| .1854 | .3723 | .1903 | .4552 |
| .2478 | .3789 | .1844 | .4503 |
| .4716 | .3821 | .2026 | .4478 |

| $\rho_{21}^*$ | $u_{21}^*$ | $v_2^*$ | $p_{21}^*$ |
|---|---|---|---|
| .0000 | .1091 | .2062 | .3694 |
| .0000 | .1108 | .2081 | .3684 |
| .0005 | .1125 | .2098 | .3673 |
| .0014 | .1143 | .2113 | .3663 |
| .0029 | .1162 | .2126 | .3651 |
| .0047 | .1180 | .2137 | .3640 |
| .0070 | .1199 | .2146 | .3628 |
| .0098 | .1218 | .2153 | .3615 |
| .0129 | .1236 | .2157 | .3603 |
| .0166 | .1255 | .2159 | .3589 |
| .0208 | .1273 | .2159 | .3576 |
| .0254 | .1291 | .2156 | .3562 |
| .0306 | .1309 | .2151 | .3548 |
| .0364 | .1327 | .2143 | .3534 |
| .0430 | .1343 | .2133 | .3519 |
| .0503 | .1360 | .2119 | .3505 |
| .0584 | .1375 | .2101 | .3490 |
| .0677 | .1391 | .2080 | .3476 |
| .0783 | .1405 | .2054 | .3462 |
| .0906 | .1418 | .2023 | .3448 |
| .1051 | .1431 | .1987 | .3435 |
| .1229 | .1442 | .1942 | .3423 |
| .1460 | .1452 | .1888 | .3411 |
| .1796 | .1461 | .1819 | .3401 |
| .2458 | .1468 | .1728 | .3392 |
| .4715 | .1470 | .1852 | .3389 |

Organigramme pour le calcul
de la solution de
l'hypersonique

entrée des données
$\hat{n}$, $\gamma$, pas, N(nombre de points)

calcul de la solution de base
(ordre 0)
$\xi$, $\xi_0$, $\xi_0'$, $u_0$, $p_0$, $\rho_0$, $\overset{*}{\tilde{u}}_0$, $\overset{*}{p}_0$

calcul de la solution pour
l'effet d'ordre 1 de
l'incidence
$\hat{\xi}_1$, $\hat{u}_1$, $\hat{v}_1$, $\hat{p}_1$, $\hat{\rho}_1$

$\overset{*}{\hat{u}}_1$, $\overset{*}{\hat{v}}_1$, $\overset{*}{\hat{p}}_1$, $\overset{*}{\hat{\rho}}_1$

calcul de la solution pour
l'effet de la contre-pression
$\xi_{22}$, $u_{22}$, $p_{22}$, $\rho_{22}$

$u_{22}^{*}$, $p_{22}^{*}$, $\rho_{22}^{*}$

# Résultats numériques sur l'hypersonique

# tableaux 27

## Valeurs des constantes en hypersonique

On pose:

$$\hat{n} = \frac{2 + \alpha}{4}$$

### $\hat{n} = 0.5$

|          | $\gamma = 1.2$ | $\gamma = 1.4$ |
|----------|----------------|----------------|
| $\xi_0$     | 0.9548         | 1.0040         |
| $\beta$     | 1.0000         | 1.0000         |
| $\xi_{22}$  | 1.0000         | 0.9919         |

Les coefficients $\xi_0'$, $\xi_1$, $\xi_{j=22,23,21}'$ et $\xi_{j=23,21}$ sont tous nuls.

Pour $\alpha \neq 0$, tous les coefficients $\xi_{j=22,23,21}'$ sont nuls.

### $\hat{n} = 0.6667$

|          | $\gamma = 1.2$ | $\gamma = 1.4$ |
|----------|----------------|----------------|
| $\xi_0$     | 0.8994         | 0.9567         |
| $\xi_0'$    | 0.9041         | 0.8388         |
| $p_0'$      | 0.9008         | 1.0363         |
| $\xi_1$     | 0.0976         | 0.1450         |
| $\beta$     | 0.5647         | 0.5456         |
| $\xi_{22}$  | 1.0365         | 0.9323         |

### $\hat{n} = 0.7$

|          | $\gamma = 1.2$ | $\gamma = 1.4$ |
|----------|----------------|----------------|
| $\xi_0$     | 0.8891         | 0.9406         |
| $\xi_0'$    | 0.9163         | 0.8564         |
| $p_0'$      | 0.9267         | 1.0578         |
| $\xi_1$     | 0.0489         | 0.0766         |
| $\beta$     | 0.5628         | 0.5489         |
| $\xi_{22}$  | 0.9704         | 0.8862         |

$\hat{n} = 0.75$

| | $\gamma = 1.2$ | $\gamma = 1.4$ |
|---|---|---|
| $\xi_0$ | 0.8715 | 0.9166 |
| $\xi_0'$ | 0.8289 | 0.8751 |
| $p_0'$ | 0.9662 | 1.0939 |
| $\xi_1$ | 0.0114 | 0.0170 |
| $\beta$ | 0.5535 | 0.5442 |
| $\xi_{22}$ | 0.8651 | 0.8073 |

$\hat{n} = 0.8$

| | $\gamma = 1.33$ | $\gamma = 1.4$ |
|---|---|---|
| $\xi_0$ | 0.8531 | 0.8934 |
| $\xi_0'$ | 0.9373 | 0.8880 |
| $p_0'$ | 1.0038 | 1.1302 |
| $\xi_1$ | $-0.0084$ | $-0.0158$ |
| $\beta$ | 0.5418 | 0.5352 |
| $\xi_{22}$ | 0.7674 | 0.7274 |

$\hat{n} = 0.85$

| | $\gamma = 1.2$ | $\gamma = 1.4$ |
|---|---|---|
| $\xi_0$ | 0.8347 | 0.8713 |
| $\xi_0'$ | 0.9433 | 0.8974 |
| $p_0'$ | 1.0386 | 1.1648 |
| $\xi_1$ | $-0.0191$ | $-0.0343$ |
| $\beta$ | 0.5299 | 0.5248 |
| $\xi_{22}$ | 0.6809 | 0.6529 |

$\hat{n} = 0.9$

| | $\gamma = 1.2$ | $\gamma = 1.4$ |
|---|---|---|
| $\xi_0$ | 0.8167 | 0.8504 |
| $\xi_0'$ | 0.9478 | 0.9047 |
| $p_0'$ | 1.0704 | 1.1969 |
| $\xi_1$ | $-0.0250$ | $-0.0450$ |
| $\beta$ | 0.5183 | 0.5141 |
| $\xi_{22}$ | 0.6058 | 0.5860 |

$\hat{n} = 0.95$

|  | $\gamma = 1.2$ | $\gamma = 1.4$ |
|---|---|---|
| $\xi_0$ | 0.7993 | 0.8306 |
| $\xi_0'$ | 0.9513 | 0.9103 |
| $p_0'$ | 1.0995 | 1.2267 |
| $\xi_1$ | $-0.0283$ | $-0.0510$ |
| $\beta$ | 0.5073 | 0.5037 |
| $\xi_{22}$ | 0.5413 | 0.5271 |

$\hat{n} = 1.$

|  | $\gamma = 1.2$ | $\gamma = 1.4$ |
|---|---|---|
| $\xi_0$ | 0.7827 | 0.8120 |
| $\xi_0'$ | 0.9541 | 0.9149 |
| $p_0'$ | 1.1260 | 1.2540 |
| $\xi_1$ | $-0.0295$ | $-0.0533$ |
| $\beta$ | 0.4969 | 0.4936 |
| $\xi_{22}$ | 0.4769 | 0.4569 |

# tableaux 28

Coefficients de pression, de traînée et de portance

| $\hat{n}$ | 2/3 | 0.75 | 1 |
|---|---|---|---|
| $C_{p_0}$ | 0.1918 | 0.2564 | 0.5225 |
| $C_{p_1}$ | $-1.1514$ | $-1.4285$ | $-2.0372$ |
| $C_{p_2}$ | 0.7979 | 0.8002 | 0.3115 |
| $C_{x_0}$ | 0.3822 | 0.385 | 0.5225 |
| $C_{x_2}$ | 0.107 | 0.202 | $-0,038$ |
| $C_{z/\alpha_i}$ | 1.725 | 1.907 | 2.038 |

# tableaux 29

# $\hat{n} = 0.6667$ et $\gamma = 1.2$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|--------|--------|--------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9857 | .8158 | .9951 | .9247 |
| .9747 | .6929 | .9925 | .8777 |
| .9659 | .6045 | .9911 | .8461 |
| .9589 | .5376 | .9903 | .8239 |
| .9531 | .4850 | .9900 | .8077 |
| .9483 | .4423 | .9899 | .7954 |
| .9442 | .4069 | .9899 | .7860 |
| .9407 | .3771 | .9900 | .7786 |
| .9377 | .3515 | .9902 | .7727 |
| .9339 | .3193 | .9904 | .7658 |
| .9308 | .2926 | .9907 | .7606 |
| .9274 | .2635 | .9910 | .7555 |
| .9241 | .2345 | .9914 | .7511 |
| .9207 | .2034 | .9918 | .7470 |
| .9175 | .1738 | .9922 | .7437 |
| .9144 | .1437 | .9927 | .7411 |
| .9115 | .1124 | .9932 | .7390 |
| .9085 | .0771 | .9937 | .7374 |
| .9055 | .0349 | .9942 | .7365 |
| .9041 | .0027 | .9945 | .7364 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | $-.1000$ |
| 1.0095 | .9518 | $-.0717$ |
| 1.0182 | .9239 | $-.0538$ |
| 1.0260 | .9068 | $-.0417$ |
| 1.0328 | .8960 | $-.0332$ |
| 1.0387 | .8891 | $-.0270$ |
| 1.0439 | .8846 | $-.0223$ |
| 1.0484 | .8817 | $-.0187$ |
| 1.0524 | .8798 | $-.0159$ |
| 1.0559 | .8787 | $-.0136$ |
| 1.0605 | .8780 | $-.0110$ |
| 1.0643 | .8779 | $-.0091$ |
| 1.0685 | .8784 | $-.0071$ |
| 1.0727 | .8795 | $-.0055$ |
| 1.0773 | .8812 | $-.0039$ |
| 1.0815 | .8835 | $-.0027$ |
| 1.0856 | .8862 | $-.0017$ |
| 1.0897 | .8895 | $-.0010$ |
| 1.0938 | .8935 | $-.0004$ |
| 1.0980 | .8982 | $-.0001$ |
| 1.0999 | .9008 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-1.3753$ | .2565 | $-1.5524$ | $-3.2839$ | .1005 |
| $-1.5842$ | .2231 | $-1.4062$ | $-3.2724$ | .1060 |
| $-1.6307$ | .1980 | $-1.3014$ | $-3.2541$ | .0989 |
| $-1.6167$ | .1783 | $-1.2234$ | $-3.2373$ | .0889 |
| $-1.5787$ | .1623 | $-1.1641$ | $-3.2237$ | .0790 |
| $-1.5310$ | .1490 | $-1.1193$ | $-3.2131$ | .0700 |
| $-1.4804$ | .1378 | $-1.0857$ | $-3.2049$ | .0621 |
| $-1.4302$ | .1283 | $-1.0610$ | $-3.1987$ | .0554 |
| $-1.3818$ | .1201 | $-1.0434$ | $-3.1941$ | .0495 |
| $-1.3358$ | .1129 | $-1.0316$ | $-3.1908$ | .0445 |
| $-1.2719$ | .1038 | $-1.0229$ | $-3.1875$ | .0383 |
| $-1.2138$ | .0961 | $-1.0225$ | $-3.1856$ | .0332 |
| $-1.1447$ | .0876 | $-1.0320$ | $-3.1847$ | .0279 |
| $-1.0698$ | .0790 | $-1.0558$ | $-3.1850$ | .0229 |
| $-.9822$ | .0698 | $-1.1051$ | $-3.1869$ | .0178 |
| $-.8918$ | .0609 | $-1.1867$ | $-3.1901$ | .0135 |
| $-.7919$ | .0518 | $-1.3267$ | $-3.1951$ | .0096 |
| $-.6781$ | .0422 | $-1.5837$ | $-3.2018$ | .0061 |
| $-.5361$ | .0311 | $-2.1764$ | $-3.2110$ | .0031 |
| $-.3332$ | .0162 | $-4.6285$ | $-3.2232$ | .0007 |
| .0000 | $-.0028$ | $-59.4507$ | $-3.2310$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .2964 | −1.5524 | −2.7072 |
| .2141 | −.6028 | .2434 | −1.3861 | −2.7916 |
| .3698 | −.8746 | .2068 | −1.2685 | −2.8121 |
| .4883 | −1.0033 | .1802 | −1.1817 | −2.8098 |
| .5816 | −1.0627 | .1599 | −1.1163 | −2.7994 |
| .6572 | −1.0853 | .1439 | −1.0668 | −2.7865 |
| .7199 | −1.0877 | .1310 | −1.0295 | −2.7736 |
| .7730 | −1.0788 | .1204 | −1.0017 | −2.7614 |
| .8188 | −1.0634 | .1116 | −.9815 | −2.7504 |
| .8589 | −1.0445 | .1040 | −.9674 | −2.7465 |
| .9112 | −1.0131 | .0946 | −.9553 | −2.7277 |
| .9565 | −.9807 | .0870 | −.9517 | −2.7170 |
| 1.0091 | −.9385 | .0787 | −.9571 | −2.7054 |
| 1.0666 | −.8892 | .0706 | −.9757 | −2.6951 |
| 1.1378 | −.8280 | .0620 | −1.0175 | −2.6827 |
| 1.2208 | −.7617 | .0539 | −1.0888 | −2.6727 |
| 1.3333 | −.6855 | .0457 | −1.2132 | −2.6635 |
| 1.5109 | −.5958 | .0372 | −1.4435 | −2.6554 |
| 1.8906 | −.4802 | .0275 | −1.9772 | −2.6482 |
| 3.4664 | −.3085 | .0144 | −4.1913 | −2.6427 |
| 40.6133 | .0000 | −.0025 | −53.7509 | −2.6412 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| −37.1046 | −.6011 | −2.1662 |
| −23.6172 | −.4549 | .3896 |
| −16.1682 | −.3650 | 1.7239 |
| −11.6214 | −.3050 | 2.4907 |
| −8.6460 | −.2620 | 2.9638 |
| −6.5972 | −.2297 | 3.2715 |
| −5.1297 | −.2045 | 3.4804 |
| −4.0454 | −.1842 | 3.6272 |
| −3.2238 | −.1673 | 3.7336 |
| −2.5882 | −.1532 | 3.8127 |
| −1.8775 | −.1357 | 3.8975 |
| −1.3659 | −.1214 | 3.9562 |
| −.8846 | −.1061 | 4.0097 |
| −.4858 | −.0912 | 4.0534 |
| −.1458 | −.0756 | 4.0914 |
| .0933 | −.0613 | 4.1205 |
| .2549 | −.0473 | 4.1448 |
| .3381 | −.0336 | 4.1662 |
| .3321 | −.0197 | 4.1870 |
| .1957 | −.0059 | 4.2088 |
| .0000 | .0008 | 4.2208 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-22.5000$ | $-.1771$ | $3.9583$ | $-.2073$ |
| $-13.1960$ | $-.1991$ | $4.4976$ | $-.4161$ |
| $-8.1384$ | $-.2088$ | $4.6033$ | $-.4561$ |
| $-5.1073$ | $-.2100$ | $4.5627$ | $-.4333$ |
| $-3.1666$ | $-.2060$ | $4.4746$ | $-.4017$ |
| $-1.8645$ | $-.1990$ | $4.3755$ | $-.3610$ |
| $-.9595$ | $-.1906$ | $4.2795$ | $-.3221$ |
| $-.3134$ | $-.1815$ | $4.1917$ | $-.2867$ |
| $.1571$ | $-.1723$ | $4.1135$ | $-.2554$ |
| $.5051$ | $-.1634$ | $4.0446$ | $-.2280$ |
| $.8701$ | $-.1506$ | $3.9569$ | $-.1934$ |
| $1.1092$ | $-.1390$ | $3.8851$ | $-.1652$ |
| $1.3052$ | $-.1251$ | $3.8088$ | $-.1356$ |
| $1.4320$ | $-.1104$ | $3.7367$ | $-.1078$ |
| $1.4917$ | $-.0937$ | $3.6654$ | $-.0805$ |
| $1.4749$ | $-.0775$ | $3.6052$ | $-.0577$ |
| $1.3844$ | $-.0608$ | $3.5531$ | $-.0381$ |
| $1.2123$ | $-.0439$ | $3.5097$ | $-.0219$ |
| $.9260$ | $-.0261$ | $3.4753$ | $-.0092$ |
| $.4579$ | $-.0081$ | $3.4540$ | $-.0014$ |
| $.0000$ | $.0007$ | $3.4502$ | $.0000$ |

# tableaux 30

## $\hat{n} = 0.6667$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|-------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9764 | .8528 | .9936 | .9292 |
| .9579 | .7485 | .9906 | .8831 |
| .9431 | .6699 | .9894 | .8511 |
| .9309 | .6080 | .9891 | .8279 |
| .9208 | .5577 | .9894 | .8106 |
| .9123 | .5158 | .9900 | .7972 |
| .9050 | .4802 | .9907 | .7867 |
| .8988 | .4495 | .9915 | .7782 |
| .8911 | .4106 | .9927 | .7685 |
| .8867 | .3884 | .9935 | .7634 |
| .8811 | .3594 | .9946 | .7573 |
| .8751 | .3270 | .9960 | .7513 |
| .8703 | .3001 | .9971 | .7469 |
| .8647 | .2673 | .9986 | .7422 |
| .8599 | .2370 | .9999 | .7386 |
| .8550 | .2041 | 1.0013 | .7355 |
| .8502 | .1670 | 1.0028 | .7328 |
| .8456 | .1244 | 1.0043 | .7308 |
| .8410 | .0672 | 1.0058 | .7294 |
| .8388 | .0036 | 1.0065 | .7291 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0176 | .9746 | $-.1483$ |
| 1.0341 | .9623 | $-.1140$ |
| 1.0491 | .9570 | $-.0899$ |
| 1.0625 | .9554 | $-.0724$ |
| 1.0745 | .9560 | $-.0593$ |
| 1.0852 | .9578 | $-.0493$ |
| 1.0947 | .9604 | $-.0414$ |
| 1.1031 | .9633 | $-.0352$ |
| 1.1141 | .9679 | $-.0280$ |
| 1.1205 | .9710 | $-.0243$ |
| 1.1288 | .9755 | $-.0199$ |
| 1.1381 | .9811 | $-.0155$ |
| 1.1458 | .9861 | $-.0123$ |
| 1.1548 | .9927 | $-.0090$ |
| 1.1628 | .9990 | $-.0065$ |
| 1.1711 | 1.0060 | $-.0043$ |
| 1.1795 | 1.0138 | $-.0025$ |
| 1.1877 | 1.0221 | $-.0011$ |
| 1.1959 | 1.0312 | $-.0002$ |
| 1.2000 | 1.0363 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| −.9666 | .4692 | −1.6550 | −3.0483 | .1820 |
| −1.2133 | .4173 | −1.5751 | −3.1516 | .1928 |
| −1.3231 | .3759 | −1.5194 | −3.2241 | .1833 |
| −1.3686 | .3420 | −1.4802 | −3.2791 | .1678 |
| −1.3810 | .3135 | −1.4534 | −3.3227 | .1512 |
| −1.3752 | .2893 | −1.4364 | −3.3585 | .1356 |
| −1.3594 | .2684 | −1.4276 | −3.3886 | .1214 |
| −1.3380 | .2501 | −1.4255 | −3.4143 | .1089 |
| −1.3136 | .2341 | −1.4290 | −3.4366 | .0979 |
| −1.2747 | .2134 | −1.4430 | −3.4650 | .0840 |
| −1.2485 | .2015 | −1.4573 | −3.4813 | .0761 |
| −1.2099 | .1858 | −1.4847 | −3.5027 | .0660 |
| −1.1609 | .1681 | −1.5306 | −3.5265 | .0553 |
| −1.1154 | .1534 | −1.5850 | −3.5462 | .0468 |
| −1.0537 | .1355 | −1.6787 | −3.5701 | .0372 |
| −.9912 | .1191 | −1.8017 | −3.5916 | .0292 |
| −.9163 | .1014 | −1.9950 | −3.6145 | .0215 |
| −.8232 | .0818 | −2.3316 | −3.6390 | .0142 |
| −.7041 | .0600 | −3.0102 | −3.6645 | .0077 |
| −.5172 | .0316 | −5.4132 | −3.6924 | .0021 |
| .0000 | −.0017 | −99.7170 | −3.7081 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .5175 | −1.6550 | −2.5650 |
| .1940 | −.4860 | .4333 | −1.5380 | −2.6704 |
| .3460 | −.7416 | .3727 | −1.4555 | −2.7127 |
| .4699 | −.8841 | .3271 | −1.3959 | −2.7277 |
| .5739 | −.9653 | .2913 | −1.3529 | −2.7301 |
| .6632 | −1.0107 | .2626 | −1.3227 | −2.7266 |
| .7413 | −1.0344 | .2391 | −1.3024 | −2.7205 |
| .8109 | −1.0444 | .2195 | −1.2901 | −2.7132 |
| .8736 | −1.0455 | .2028 | −1.2845 | −2.7058 |
| .9580 | −1.0371 | .1821 | −1.2859 | −2.6950 |
| 1.0091 | −1.0274 | .1705 | −1.2922 | −2.6884 |
| 1.0800 | −1.0094 | .1557 | −1.3082 | −2.6795 |
| 1.1662 | −.9822 | .1395 | −1.3394 | −2.6693 |
| 1.2456 | −.9539 | .1264 | −1.3794 | −2.6608 |
| 1.3562 | −.9125 | .1109 | −1.4515 | −2.6509 |
| 1.4771 | −.8676 | .0970 | −1.5492 | −2.6422 |
| 1.6413 | −.8113 | .0823 | −1.7058 | −2.6337 |
| 1.8952 | −.7383 | .0664 | −1.9824 | −2.6253 |
| 2.3655 | −.6415 | .0488 | −2.5453 | −2.6178 |
| 3.9687 | −.4838 | .0259 | −4.5526 | −2.6113 |
| 68.4753 | .0000 | −.0014 | −83.6417 | −2.6089 |

**Ecoulement d'ordre 2**
effet de la contre-pression

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-17.4654$ | $-.6961$ | .3001 |
| $-11.7579$ | $-.5619$ | 1.5480 |
| $-8.3414$ | $-.4709$ | 2.2746 |
| $-6.1242$ | $-.4050$ | 2.7356 |
| $-4.6021$ | $-.3546$ | 3.0470 |
| $-3.5134$ | $-.3146$ | 3.2673 |
| $-2.7097$ | $-.2818$ | 3.4290 |
| $-2.1013$ | $-.2545$ | 3.5513 |
| $-1.6314$ | $-.2314$ | 3.6462 |
| $-1.1076$ | $-.2025$ | 3.7533 |
| $-.8445$ | $-.1863$ | 3.8081 |
| $-.5403$ | $-.1655$ | 3.8733 |
| $-.2528$ | $-.1430$ | 3.9379 |
| $-.0547$ | $-.1248$ | 3.9858 |
| .1381 | $-.1034$ | 4.0377 |
| .2687 | $-.0848$ | 4.0799 |
| .3623 | $-.0659$ | 4.1204 |
| .4095 | $-.0466$ | 4.1600 |
| .3930 | $-.0278$ | 4.1981 |
| .2653 | $-.0091$ | 4.2369 |
| .0000 | .0003 | 4.2578 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-11.2500$ | $-.3854$ | 3.4078 | $-.3729$ |
| $-7.0816$ | $-.3820$ | 3.6259 | $-.5322$ |
| $-4.6025$ | $-.3698$ | 3.6684 | $-.5548$ |
| $-3.0091$ | $-.3528$ | 3.6460 | $-.5273$ |
| $-1.9294$ | $-.3336$ | 3.6002 | $-.4827$ |
| $-1.1697$ | $-.3136$ | 3.5474 | $-.4344$ |
| $-.6198$ | $-.2939$ | 3.4949 | $-.3880$ |
| $-.2132$ | $-.2749$ | 3.4456 | $-.3455$ |
| .0926 | $-.2570$ | 3.4006 | $-.3077$ |
| .4204 | $-.2324$ | 3.3417 | $-.2591$ |
| .5774 | $-.2175$ | 3.3077 | $-.2317$ |
| .7490 | $-.1972$ | 3.2638 | $-.1969$ |
| .8962 | $-.1738$ | 3.2163 | $-.1600$ |
| .9832 | $-.1539$ | 3.1789 | $-.1315$ |
| 1.0464 | $-.1296$ | 3.1366 | $-.0999$ |
| 1.0633 | $-.1076$ | 3.1018 | $-.0744$ |
| 1.0377 | $-.0845$ | 3.0693 | $-.0510$ |
| .9556 | $-.0604$ | 3.0399 | $-.0303$ |
| .7959 | $-.0363$ | 3.0161 | $-.0138$ |
| .4804 | $-.0120$ | 2.9995 | $-.0026$ |
| .0000 | .0002 | 2.9957 | .0000 |

# tableaux 31

## n̂ = 0.7 et γ = 1.2

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|--------|--------|--------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9762 | .7415 | .9976 | .9009 |
| .9613 | .5964 | .9982 | .8543 |
| .9513 | .5018 | .9994 | .8289 |
| .9444 | .4345 | 1.0006 | .8138 |
| .9393 | .3838 | 1.0017 | .8041 |
| .9355 | .3440 | 1.0026 | .7977 |
| .9314 | .2979 | 1.0036 | .7915 |
| .9293 | .2736 | 1.0041 | .7888 |
| .9258 | .2274 | 1.0051 | .7846 |
| .9232 | .1892 | 1.0059 | .7820 |
| .9204 | .1416 | 1.0067 | .7798 |
| .9177 | .0762 | 1.0075 | .7784 |
| .9163 | .0017 | 1.0080 | .7781 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | $-.1000$ |
| 1.0219 | .9454 | $-.0552$ |
| 1.0384 | .9245 | $-.0340$ |
| 1.0505 | .9159 | $-.0225$ |
| 1.0596 | .9125 | $-.0157$ |
| 1.0664 | .9114 | $-.0114$ |
| 1.0717 | .9115 | $-.0085$ |
| 1.0775 | .9124 | $-.0058$ |
| 1.0805 | .9133 | $-.0046$ |
| 1.0857 | .9154 | $-.0028$ |
| 1.0896 | .9176 | $-.0017$ |
| 1.0938 | .9206 | $-.0007$ |
| 1.0979 | .9243 | $-.0001$ |
| 1.1000 | .9267 | .0000 |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-.5837$ | $.2031$ | $-1.5226$ | $-2.9574$ | $.1079$ |
| $-1.0351$ | $.1428$ | $-1.2782$ | $-3.0481$ | $.0909$ |
| $-1.1198$ | $.1101$ | $-1.1401$ | $-3.0761$ | $.0694$ |
| $-1.1200$ | $.0890$ | $-1.0514$ | $-3.0898$ | $.0531$ |
| $-1.0936$ | $.0737$ | $-.9928$ | $-3.0992$ | $.0412$ |
| $-1.0556$ | $.0624$ | $-.9584$ | $-3.1061$ | $.0325$ |
| $-1.0141$ | $.0539$ | $-.9416$ | $-3.1116$ | $.0261$ |
| $-.9531$ | $.0445$ | $-.9398$ | $-3.1183$ | $.0194$ |
| $-.9150$ | $.0398$ | $-.9497$ | $-3.1221$ | $.0162$ |
| $-.8312$ | $.0313$ | $-1.0000$ | $-3.1296$ | $.0109$ |
| $-.7500$ | $.0249$ | $-1.0905$ | $-3.1361$ | $.0072$ |
| $-.6330$ | $.0175$ | $-1.3206$ | $-3.1443$ | $.0038$ |
| $-.4389$ | $.0087$ | $-2.2585$ | $-3.1548$ | $.0010$ |
| $.0000$ | $-.0002$ | $-99.6609$ | $-3.1614$ | $.0000$ |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| $.0000$ | $.0000$ | $.2127$ | $-1.5226$ | $-2.7176$ |
| $.3548$ | $-.6842$ | $.1398$ | $-1.2478$ | $-2.7827$ |
| $.5727$ | $-.8696$ | $.1035$ | $-1.0959$ | $-2.7698$ |
| $.7212$ | $-.9247$ | $.0815$ | $-1.0003$ | $-2.7488$ |
| $.8288$ | $-.9325$ | $.0664$ | $-.9376$ | $-2.7309$ |
| $.9112$ | $-.9179$ | $.0556$ | $-.9002$ | $-2.7165$ |
| $.9774$ | $-.8934$ | $.0477$ | $-.8809$ | $-2.7053$ |
| $1.0579$ | $-.8509$ | $.0392$ | $-.8753$ | $-2.6929$ |
| $1.1036$ | $-.8222$ | $.0349$ | $-.8826$ | $-2.6867$ |
| $1.2023$ | $-.7553$ | $.0274$ | $-.9258$ | $-2.6763$ |
| $1.3067$ | $-.6876$ | $.0218$ | $-1.0067$ | $-2.6691$ |
| $1.5031$ | $-.5867$ | $.0154$ | $-1.2155$ | $-2.6621$ |
| $2.1959$ | $-.4142$ | $.0077$ | $-2.0725$ | $-2.6564$ |
| $79.3289$ | $.0000$ | $-.0002$ | $-91.3220$ | $-2.6545$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| −32.0024 | −.4277 | −1.3295 |
| −16.4323 | −.2439 | 1.5170 |
| −9.8022 | −.1654 | 2.5568 |
| −6.3380 | −.1231 | 3.0243 |
| −4.3065 | −.0963 | 3.2647 |
| −3.0245 | −.0780 | 3.3994 |
| −2.1700 | −.0647 | 3.4805 |
| −1.3468 | −.0507 | 3.5511 |
| −.9829 | −.0438 | 3.5800 |
| −.4238 | −.0318 | 3.6217 |
| −.0903 | −.0231 | 3.6460 |
| .1663 | −.0138 | 3.6672 |
| .2486 | −.0045 | 3.6856 |
| .0000 | .0000 | 3.6950 |

| $\rho_{22}^{*}$ | $u_{22}^{*}$ | $p_{22}^{*}$ | $\psi_{22}$ |
|---|---|---|---|
| −20.4082 | −.2387 | 3.4342 | −.1941 |
| −9.4617 | −.2311 | 3.8717 | −.3705 |
| −4.8343 | −.2072 | 3.8095 | −.3310 |
| −2.4588 | −.1799 | 3.6824 | −.2670 |
| −1.1067 | −.1543 | 3.5677 | −.2110 |
| −.2893 | −.1325 | 3.4751 | −.1671 |
| .2263 | −.1143 | 3.4029 | −.1335 |
| .6820 | −.0928 | 3.3239 | −.0974 |
| .8612 | −.0815 | 3.2855 | −.0801 |
| 1.0837 | −.0607 | 3.2210 | −.0514 |
| 1.1505 | −.0446 | 3.1778 | −.0325 |
| 1.0864 | −.0271 | 3.1384 | −.0153 |
| .7397 | −.0090 | 3.1094 | −.0029 |
| .0000 | .0000 | 3.1025 | .0000 |

# tableaux 32

## $\hat{n} = 0.7$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|---------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9643 | .8112 | .9988 | .9159 |
| .9399 | .6895 | 1.0012 | .8702 |
| .9225 | .6025 | 1.0045 | .8424 |
| .9097 | .5364 | 1.0077 | .8244 |
| .9001 | .4840 | 1.0105 | .8122 |
| .8927 | .4412 | 1.0129 | .8037 |
| .8869 | .4055 | 1.0149 | .7975 |
| .8824 | .3753 | 1.0166 | .7930 |
| .8771 | .3375 | 1.0187 | .7883 |
| .8722 | .2976 | 1.0207 | .7842 |
| .8674 | .2527 | 1.0227 | .7808 |
| .8631 | .2018 | 1.0246 | .7783 |
| .8586 | .1224 | 1.0267 | .7763 |
| .8564 | .0025 | 1.0277 | .7758 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|---------|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0357 | .9850 | $-.1239$ |
| 1.0652 | .9850 | $-.0821$ |
| 1.0888 | .9898 | $-.0570$ |
| 1.1076 | .9961 | $-.0410$ |
| 1.1226 | 1.0025 | $-.0303$ |
| 1.1346 | 1.0085 | $-.0230$ |
| 1.1443 | 1.0138 | $-.0178$ |
| 1.1522 | 1.0186 | $-.0140$ |
| 1.1614 | 1.0246 | $-.0100$ |
| 1.1703 | 1.0310 | $-.0067$ |
| 1.1791 | 1.0378 | $-.0040$ |
| 1.1872 | 1.0448 | $-.0019$ |
| 1.1958 | 1.0531 | $-.0004$ |
| 1.2000 | 1.0578 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| −.4284 | .3860 | −1.6377 | −2.8444 | .2047 |
| −.8433 | .2975 | −1.5103 | −3.0781 | .1829 |
| −.9982 | .2393 | −1.4324 | −3.2157 | .1487 |
| −1.0577 | .1979 | −1.3848 | −3.3065 | .1189 |
| −1.0745 | .1665 | −1.3594 | −3.3710 | .0952 |
| −1.0695 | .1423 | −1.3519 | −3.4187 | .0768 |
| −1.0535 | .1232 | −1.3585 | −3.4551 | .0626 |
| −1.0319 | .1079 | −1.3765 | −3.4836 | .0515 |
| −1.0078 | .0954 | −1.4034 | −3.5063 | .0429 |
| −.9701 | .0807 | −1.4572 | −3.5328 | .0331 |
| −.9212 | .0661 | −1.5473 | −3.5583 | .0242 |
| −.8549 | .0510 | −1.7091 | −3.5836 | .0160 |
| −.7650 | .0360 | −2.0205 | −3.6079 | .0090 |
| −.5919 | .0170 | −3.1498 | −3.6349 | .0025 |
| .0000 | −.0001 | −153.1696 | −3.6495 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .3951 | −1.6377 | −2.6384 |
| .2989 | −.5521 | .2841 | −1.4564 | −2.7442 |
| .5155 | −.7771 | .2181 | −1.3463 | −2.7647 |
| .6831 | −.8788 | .1746 | −1.2775 | −2.7615 |
| .8189 | −.9236 | .1436 | −1.2367 | −2.7521 |
| .9328 | −.9386 | .1208 | −1.2168 | −2.7417 |
| 1.0314 | −.9376 | .1034 | −1.2128 | −2.7321 |
| 1.1191 | −.9277 | .0898 | −1.2208 | −2.7238 |
| 1.1989 | −.9129 | .0789 | −1.2383 | −2.7168 |
| 1.3079 | −.8863 | .0663 | −1.2781 | −2.7084 |
| 1.4403 | −.8485 | .0541 | −1.3495 | −2.7003 |
| 1.6237 | −.7941 | .0417 | −1.4825 | −2.6925 |
| 1.9121 | −.7169 | .0295 | −1.7438 | −2.6856 |
| 2.8172 | −.5631 | .0140 | −2.7043 | −2.6791 |
| 122.6644 | .0000 | −.0001 | −131.1753 | −2.6767 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-15.1628$ | $-.5004$ | $.6158$ |
| $-8.9416$ | $-.3387$ | $1.9620$ |
| $-5.7471$ | $-.2502$ | $2.6087$ |
| $-3.8711$ | $-.1943$ | $2.9677$ |
| $-2.6783$ | $-.1556$ | $3.1860$ |
| $-1.8788$ | $-.1274$ | $3.3270$ |
| $-1.3219$ | $-.1060$ | $3.4224$ |
| $-.9224$ | $-.0894$ | $3.4897$ |
| $-.6292$ | $-.0763$ | $3.5388$ |
| $-.3214$ | $-.0612$ | $3.5905$ |
| $-.0642$ | $-.0469$ | $3.6352$ |
| $.1445$ | $-.0329$ | $3.6751$ |
| $.2831$ | $-.0201$ | $3.7090$ |
| $.3105$ | $-.0066$ | $3.7431$ |
| $.0000$ | $.0000$ | $3.7601$ |

| $\rho_{22}^{*}$ | $u_{22}^{*}$ | $p_{22}^{*}$ | $\psi_{22}$ |
|---|---|---|---|
| $-10.2041$ | $-.3949$ | $3.0002$ | $-.3545$ |
| $-5.5716$ | $-.3582$ | $3.1913$ | $-.4729$ |
| $-3.1883$ | $-.3139$ | $3.1850$ | $-.4292$ |
| $-1.8001$ | $-.2710$ | $3.1323$ | $-.3577$ |
| $-.9317$ | $-.2325$ | $3.0737$ | $-.2905$ |
| $-.3635$ | $-.1994$ | $3.0204$ | $-.2345$ |
| $.0201$ | $-.1714$ | $2.9752$ | $-.1897$ |
| $.2845$ | $-.1480$ | $2.9379$ | $-.1544$ |
| $.4692$ | $-.1284$ | $2.9075$ | $-.1265$ |
| $.6487$ | $-.1048$ | $2.8725$ | $-.0953$ |
| $.7776$ | $-.0815$ | $2.8398$ | $-.0670$ |
| $.8492$ | $-.0580$ | $2.8096$ | $-.0417$ |
| $.8393$ | $-.0357$ | $2.7845$ | $-.0212$ |
| $.6446$ | $-.0118$ | $2.7635$ | $-.0044$ |
| $.0000$ | $.0000$ | $2.7578$ | $.0000$ |

# tableaux 33

## $\hat{n} = 0.75$ et $\gamma = 1.2$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9899 | .9098 | 1.0012 | .9659 |
| .9816 | .8364 | 1.0028 | .9403 |
| .9747 | .7753 | 1.0044 | .9207 |
| .9689 | .7234 | 1.0059 | .9055 |
| .9641 | .6786 | 1.0074 | .8935 |
| .9599 | .6395 | 1.0087 | .8838 |
| .9564 | .6049 | 1.0100 | .8761 |
| .9534 | .5741 | 1.0111 | .8698 |
| .9508 | .5465 | 1.0121 | .8646 |
| .9486 | .5215 | 1.0129 | .8603 |
| .9457 | .4882 | 1.0141 | .8552 |
| .9428 | .4501 | 1.0154 | .8501 |
| .9399 | .4102 | 1.0166 | .8457 |
| .9375 | .3709 | 1.0177 | .8422 |
| .9350 | .3244 | 1.0188 | .8390 |
| .9326 | .2653 | 1.0200 | .8363 |
| .9301 | .1727 | 1.0212 | .8343 |
| .9289 | .0058 | 1.0218 | .8337 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|----------|
| 1.0000 | 1.0000 | $-.1000$ |
| 1.0114 | .9856 | $-.0790$ |
| 1.0215 | .9758 | $-.0632$ |
| 1.0304 | .9691 | $-.0512$ |
| 1.0382 | .9645 | $-.0420$ |
| 1.0450 | .9613 | $-.0347$ |
| 1.0509 | .9592 | $-.0290$ |
| 1.0560 | .9578 | $-.0243$ |
| 1.0605 | .9569 | $-.0206$ |
| 1.0644 | .9564 | $-.0176$ |
| 1.0679 | .9561 | $-.0151$ |
| 1.0723 | .9561 | $-.0121$ |
| 1.0770 | .9565 | $-.0092$ |
| 1.0816 | .9572 | $-.0067$ |
| 1.0855 | .9582 | $-.0047$ |
| 1.0896 | .9597 | $-.0029$ |
| 1.0938 | .9616 | $-.0014$ |
| 1.0979 | .9644 | $-.0003$ |
| 1.1000 | .9662 | .0000 |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-.1036$ | .1496 | $-1.4553$ | $-2.6770$ | .1120 |
| $-.3384$ | .1248 | $-1.3491$ | $-2.7491$ | .1012 |
| $-.4954$ | .1055 | $-1.2586$ | $-2.7996$ | .0897 |
| $-.6030$ | .0902 | $-1.1813$ | $-2.8362$ | .0789 |
| $-.6778$ | .0778 | $-1.1151$ | $-2.8637$ | .0691 |
| $-.7301$ | .0678 | $-1.0584$ | $-2.8847$ | .0605 |
| $-.7666$ | .0594 | $-1.0097$ | $-2.9013$ | .0531 |
| $-.7917$ | .0525 | $-.9681$ | $-2.9146$ | .0466 |
| $-.8085$ | .0467 | $-.9326$ | $-2.9254$ | .0410 |
| $-.8191$ | .0418 | $-.9024$ | $-2.9343$ | .0363 |
| $-.8251$ | .0376 | $-.8767$ | $-2.9419$ | .0321 |
| $-.8278$ | .0324 | $-.8457$ | $-2.9511$ | .0270 |
| $-.8233$ | .0269 | $-.8157$ | $-2.9606$ | .0216 |
| $-.8102$ | .0218 | $-.7926$ | $-2.9695$ | .0166 |
| $-.7886$ | .0174 | $-.7805$ | $-2.9772$ | .0124 |
| $-.7520$ | .0129 | $-.7849$ | $-2.9852$ | .0083 |
| $-.6876$ | .0083 | $-.8332$ | $-2.9935$ | .0045 |
| $-.5449$ | .0034 | $-1.0971$ | $-3.0028$ | .0012 |
| .0000 | .0000 | $-30.5008$ | $-3.0083$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1485 | $-1.4553$ | $-2.6363$ |
| .1476 | $-.2517$ | .1220 | $-1.3355$ | $-2.6625$ |
| .2715 | $-.4209$ | .1018 | $-1.2355$ | $-2.6727$ |
| .3767 | $-.5377$ | .0860 | $-1.1514$ | $-2.6746$ |
| .4668 | $-.6196$ | .0736 | $-1.0805$ | $-2.6721$ |
| .5447 | $-.6775$ | .0635 | $-1.0203$ | $-2.6676$ |
| .6124 | $-.7186$ | .0554 | $-.9693$ | $-2.6621$ |
| .6719 | $-.7475$ | .0487 | $-.9259$ | $-2.6565$ |
| .7244 | $-.7675$ | .0431 | $-.8891$ | $-2.6510$ |
| .7711 | $-.7808$ | .0384 | $-.8580$ | $-2.6458$ |
| .8129 | $-.7892$ | .0344 | $-.8316$ | $-2.6411$ |
| .8681 | $-.7948$ | .0295 | $-.7998$ | $-2.6347$ |
| .9306 | $-.7935$ | .0244 | $-.7690$ | $-2.6277$ |
| .9958 | $-.7835$ | .0197 | $-.7450$ | $-2.6208$ |
| 1.0608 | $-.7648$ | .0157 | $-.7317$ | $-2.6148$ |
| 1.1416 | $-.7315$ | .0116 | $-.7339$ | $-2.6087$ |
| 1.2602 | $-.6711$ | .0075 | $-.7770$ | $-2.6028$ |
| 1.5627 | $-.5343$ | .0031 | $-1.0204$ | $-2.5976$ |
| 31.2754 | .0000 | .0000 | $-28.3318$ | $-2.5957$ |

**Ecoulement d'ordre 2
effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-25.6423$ | $-.2573$ | $-.3579$ |
| $-20.7690$ | $-.1970$ | $.5315$ |
| $-17.1591$ | $-.1552$ | $1.1452$ |
| $-14.3996$ | $-.1253$ | $1.5815$ |
| $-12.2371$ | $-.1032$ | $1.8992$ |
| $-10.5079$ | $-.0865$ | $2.1351$ |
| $-9.1021$ | $-.0736$ | $2.3130$ |
| $-7.9429$ | $-.0633$ | $2.4492$ |
| $-6.9757$ | $-.0551$ | $2.5546$ |
| $-6.1601$ | $-.0484$ | $2.6373$ |
| $-5.4664$ | $-.0428$ | $2.7027$ |
| $-4.6053$ | $-.0361$ | $2.7771$ |
| $-3.7096$ | $-.0292$ | $2.8461$ |
| $-2.8756$ | $-.0231$ | $2.9018$ |
| $-2.1558$ | $-.0178$ | $2.9430$ |
| $-1.4338$ | $-.0127$ | $2.9774$ |
| $-.7168$ | $-.0076$ | $3.0046$ |
| $-.0278$ | $-.0025$ | $3.0244$ |
| $.0000$ | $.0000$ | $3.0318$ |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-17.7778$ | $-.3359$ | $2.7355$ | $-.1730$ |
| $-14.1859$ | $-.3118$ | $2.9082$ | $-.2512$ |
| $-11.5029$ | $-.2870$ | $2.9898$ | $-.2798$ |
| $-9.4399$ | $-.2627$ | $3.0202$ | $-.2821$ |
| $-7.8172$ | $-.2397$ | $3.0220$ | $-.2710$ |
| $-6.5171$ | $-.2183$ | $3.0080$ | $-.2534$ |
| $-5.4594$ | $-.1986$ | $2.9857$ | $-.2332$ |
| $-4.5881$ | $-.1807$ | $2.9596$ | $-.2126$ |
| $-3.8626$ | $-.1645$ | $2.9324$ | $-.1927$ |
| $-3.2529$ | $-.1498$ | $2.9056$ | $-.1741$ |
| $-2.7364$ | $-.1367$ | $2.8801$ | $-.1570$ |
| $-2.1000$ | $-.1194$ | $2.8451$ | $-.1344$ |
| $-1.4463$ | $-.1003$ | $2.8051$ | $-.1094$ |
| $-.8499$ | $-.0815$ | $2.7651$ | $-.0852$ |
| $-.3513$ | $-.0645$ | $2.7291$ | $-.0639$ |
| $.1225$ | $-.0467$ | $2.6925$ | $-.0428$ |
| $.5404$ | $-.0284$ | $2.6570$ | $-.0227$ |
| $.7827$ | $-.0095$ | $2.6259$ | $-.0055$ |
| $.0000$ | $.0000$ | $2.6159$ | $.0000$ |

# tableaux 34

## $\hat{n} = 0.75$ et $\gamma = 1.4$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|-------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9848 | .9366 | 1.0030 | .9732 |
| .9717 | .8821 | 1.0063 | .9518 |
| .9604 | .8343 | 1.0096 | .9345 |
| .9507 | .7919 | 1.0128 | .9202 |
| .9422 | .7540 | 1.0159 | .9084 |
| .9348 | .7197 | 1.0189 | .8985 |
| .9284 | .6885 | 1.0216 | .8902 |
| .9228 | .6600 | 1.0241 | .8832 |
| .9178 | .6338 | 1.0264 | .8773 |
| .9135 | .6097 | 1.0285 | .8722 |
| .9097 | .5873 | 1.0304 | .8678 |
| .9048 | .5566 | 1.0329 | .8625 |
| .9007 | .5289 | 1.0351 | .8582 |
| .8963 | .4960 | 1.0375 | .8537 |
| .8913 | .4534 | 1.0403 | .8490 |
| .8871 | .4120 | 1.0427 | .8454 |
| .8830 | .3600 | 1.0452 | .8421 |
| .8791 | .2897 | 1.0476 | .8395 |
| .8751 | .0076 | 1.0501 | .8377 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|----------|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0185 | 1.0035 | $-.1648$ |
| 1.0356 | 1.0081 | $-.1369$ |
| 1.0512 | 1.0131 | $-.1145$ |
| 1.0654 | 1.0182 | $-.0963$ |
| 1.0783 | 1.0233 | $-.0815$ |
| 1.0899 | 1.0282 | $-.0693$ |
| 1.1004 | 1.0328 | $-.0591$ |
| 1.1098 | 1.0372 | $-.0507$ |
| 1.1183 | 1.0413 | $-.0436$ |
| 1.1259 | 1.0452 | $-.0377$ |
| 1.1327 | 1.0487 | $-.0327$ |
| 1.1416 | 1.0535 | $-.0266$ |
| 1.1492 | 1.0578 | $-.0218$ |
| 1.1576 | 1.0628 | $-.0169$ |
| 1.1673 | 1.0688 | $-.0118$ |
| 1.1754 | 1.0742 | $-.0080$ |
| 1.1837 | 1.0801 | $-.0046$ |
| 1.1917 | 1.0864 | $-.0019$ |
| 1.2000 | 1.0939 | $.0000$ |

### Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-.0707$ | .2921 | $-1.5830$ | $-2.6525$ | .2218 |
| $-.2555$ | .2548 | $-1.5259$ | $-2.7737$ | .2039 |
| $-.3926$ | .2237 | $-1.4750$ | $-2.8718$ | .1850 |
| $-.4963$ | .1976 | $-1.4297$ | $-2.9524$ | .1664 |
| $-.5758$ | .1753 | $-1.3896$ | $-3.0195$ | .1490 |
| $-.6371$ | .1562 | $-1.3544$ | $-3.0760$ | .1331 |
| $-.6849$ | .1397 | $-1.3236$ | $-3.1238$ | .1187 |
| $-.7220$ | .1254 | $-1.2970$ | $-3.1646$ | .1058 |
| $-.7509$ | .1130 | $-1.2743$ | $-3.1997$ | .0944 |
| $-.7733$ | .1021 | $-1.2552$ | $-3.2299$ | .0842 |
| $-.7905$ | .0925 | $-1.2395$ | $-3.2561$ | .0753 |
| $-.8035$ | .0841 | $-1.2269$ | $-3.2790$ | .0674 |
| $-.8168$ | .0733 | $-1.2133$ | $-3.3080$ | .0572 |
| $-.8244$ | .0642 | $-1.2054$ | $-3.3319$ | .0488 |
| $-.8281$ | .0543 | $-1.2027$ | $-3.3576$ | .0397 |
| $-.8244$ | .0430 | $-1.2126$ | $-3.3866$ | .0295 |
| $-.8119$ | .0335 | $-1.2107$ | $-3.4103$ | .0214 |
| $-.7837$ | .0236 | $-1.3108$ | $-3.4342$ | .0134 |
| $-.7236$ | .0135 | $-1.4976$ | $-3.4574$ | .0062 |
| .0000 | .0000 | $-51.6905$ | $-3.4823$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .2893 | $-1.5830$ | $-2.6214$ |
| .1233 | $-.1936$ | .2476 | $-1.5026$ | $-2.6645$ |
| .2338 | $-.3375$ | .2138 | $-1.4332$ | $-2.6906$ |
| .3335 | $-.4466$ | .1861 | $-1.3731$ | $-2.7059$ |
| .4242 | $-.5304$ | .1630 | $-1.3211$ | $-2.7143$ |
| .5069 | $-.5955$ | .1436 | $-1.2761$ | $-2.7183$ |
| .5829 | $-.6463$ | .1272 | $-1.2373$ | $-2.7193$ |
| .6530 | $-.6861$ | .1133 | $-1.2041$ | $-2.7186$ |
| .7179 | $-.7173$ | .1013 | $-1.1759$ | $-2.7167$ |
| .7782 | $-.7417$ | .0909 | $-1.1521$ | $-2.7141$ |
| .8344 | $-.7606$ | .0820 | $-1.1323$ | $-2.7112$ |
| .8872 | $-.7752$ | .0741 | $-1.1161$ | $-2.7082$ |
| .9605 | $-.7905$ | .0642 | $-1.0977$ | $-2.7037$ |
| 1.0279 | $-.7998$ | .0560 | $-1.0857$ | $-2.6994$ |
| 1.1102 | $-.8054$ | .0471 | $-1.0779$ | $-2.6943$ |
| 1.2213 | $-.8041$ | .0370 | $-1.0807$ | $-2.6881$ |
| 1.3372 | $-.7937$ | .0287 | $-1.1007$ | $-2.6826$ |
| 1.5004 | $-.7681$ | .0202 | $-1.1574$ | $-2.6768$ |
| 1.7798 | $-.7112$ | .0115 | $-1.3165$ | $-2.6714$ |
| 53.2545 | .0000 | .0000 | $-45.2322$ | $-2.6665$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-12.2527$ | $-.2977$ | .9570 |
| $-10.3959$ | $-.2471$ | 1.3576 |
| $-8.9139$ | $-.2082$ | 1.6659 |
| $-7.7065$ | $-.1776$ | 1.9083 |
| $-6.7069$ | $-.1529$ | 2.1020 |
| $-5.8689$ | $-.1328$ | 2.2586 |
| $-5.1590$ | $-.1161$ | 2.3864 |
| $-4.5524$ | $-.1022$ | 2.4916 |
| $-4.0303$ | $-.0904$ | 2.5786 |
| $-3.5780$ | $-.0803$ | 2.6510 |
| $-3.1841$ | $-.0717$ | 2.7116 |
| $-2.8393$ | $-.0642$ | 2.7625 |
| $-2.3982$ | $-.0548$ | 2.8245 |
| $-2.0315$ | $-.0471$ | 2.8731 |
| $-1.6331$ | $-.0389$ | 2.9225 |
| $-1.1796$ | $-.0296$ | 2.9739 |
| $-.8028$ | $-.0221$ | 3.0125 |
| $-.4179$ | $-.0146$ | 3.0477 |
| $-.0467$ | $-.0074$ | 3.0777 |
| .0000 | .0000 | 3.1047 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −8.8889 | −.4323 | 2.4370 | −.3229 |
| −7.4496 | −.4031 | 2.5145 | −.3652 |
| −6.2905 | −.3737 | 2.5604 | −.3765 |
| −5.3405 | −.3450 | 2.5853 | −.3698 |
| −4.5510 | −.3175 | 2.5963 | −.3529 |
| −3.8876 | −.2916 | 2.5979 | −.3308 |
| −3.3251 | −.2673 | 2.5933 | −.3062 |
| −2.8445 | −.2447 | 2.5848 | −.2812 |
| −2.4311 | −.2239 | 2.5740 | −.2567 |
| −2.0737 | −.2048 | 2.5619 | −.2334 |
| −1.7631 | −.1874 | 2.5492 | −.2117 |
| −1.4921 | −.1714 | 2.5366 | −.1917 |
| −1.1471 | −.1501 | 2.5183 | −.1649 |
| −.8624 | −.1317 | 2.5014 | −.1418 |
| −.5563 | −.1109 | 2.4814 | −.1160 |
| −.2144 | −.0864 | 2.4570 | −.0865 |
| .0607 | −.0656 | 2.4359 | −.0622 |
| .3255 | −.0438 | 2.4141 | −.0382 |
| .5439 | −.0224 | 2.3938 | −.0168 |
| .0000 | .0000 | 2.3773 | .0000 |

# tableaux 35

## $\hat{n} = 0.8$ et $\gamma = 1.2$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|--------|--------|--------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9974 | .9826 | 1.0009 | .9937 |
| .9949 | .9658 | 1.0018 | .9878 |
| .9913 | .9419 | 1.0032 | .9796 |
| .9891 | .9267 | 1.0040 | .9745 |
| .9859 | .9049 | 1.0053 | .9675 |
| .9829 | .8841 | 1.0065 | .9610 |
| .9802 | .8644 | 1.0077 | .9551 |
| .9776 | .8457 | 1.0089 | .9497 |
| .9752 | .8278 | 1.0100 | .9447 |
| .9723 | .8051 | 1.0114 | .9387 |
| .9696 | .7838 | 1.0127 | .9333 |
| .9671 | .7636 | 1.0139 | .9285 |
| .9643 | .7399 | 1.0153 | .9232 |
| .9618 | .7177 | 1.0166 | .9185 |
| .9596 | .6969 | 1.0178 | .9144 |
| .9569 | .6697 | 1.0193 | .9096 |
| .9545 | .6446 | 1.0206 | .9055 |
| .9522 | .6183 | 1.0219 | .9017 |
| .9499 | .5882 | 1.0233 | .8978 |
| .9474 | .5534 | 1.0247 | .8941 |
| .9452 | .5158 | 1.0261 | .8908 |
| .9429 | .4699 | 1.0275 | .8877 |
| .9406 | .4082 | 1.0289 | .8849 |
| .9384 | .3053 | 1.0303 | .8826 |
| .9373 | .0292 | 1.0310 | .8819 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | −.1000 |
| 1.0036 | .9990 | −.0943 |
| 1.0070 | .9980 | −.0889 |
| 1.0120 | .9969 | −.0815 |
| 1.0151 | .9962 | −.0769 |
| 1.0197 | .9953 | −.0706 |
| 1.0240 | .9947 | −.0649 |
| 1.0281 | .9941 | −.0597 |
| 1.0320 | .9937 | −.0550 |
| 1.0356 | .9933 | −.0507 |
| 1.0402 | .9930 | −.0455 |
| 1.0444 | .9928 | −.0409 |
| 1.0484 | .9927 | −.0369 |
| 1.0529 | .9927 | −.0324 |
| 1.0569 | .9928 | −.0286 |
| 1.0606 | .9930 | −.0253 |
| 1.0652 | .9934 | −.0213 |
| 1.0692 | .9938 | −.0181 |
| 1.0732 | .9944 | −.0150 |
| 1.0773 | .9951 | −.0121 |
| 1.0816 | .9960 | −.0091 |
| 1.0856 | .9971 | −.0066 |
| 1.0897 | .9985 | −.0043 |
| 1.0939 | 1.0001 | −.0022 |
| 1.0979 | 1.0023 | −.0006 |
| 1.1000 | 1.0038 | .0000 |

## Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0555 | .1116 | $-1.3834$ | $-2.5008$ | .1128 |
| .0069 | .1057 | $-1.3570$ | $-2.5212$ | .1087 |
| $-.0380$ | .1002 | $-1.3313$ | $-2.5401$ | .1046 |
| $-.0990$ | .0926 | $-1.2942$ | $-2.5659$ | .0987 |
| $-.1360$ | .0879 | $-1.2703$ | $-2.5816$ | .0949 |
| $-.1865$ | .0814 | $-1.2358$ | $-2.6030$ | .0894 |
| $-.2317$ | .0755 | $-1.2029$ | $-2.6224$ | .0841 |
| $-.2723$ | .0700 | $-1.1714$ | $-2.6398$ | .0792 |
| $-.3088$ | .0651 | $-1.1414$ | $-2.6555$ | .0745 |
| $-.3417$ | .0605 | $-1.1127$ | $-2.6697$ | .0700 |
| $-.3807$ | .0551 | $-1.0765$ | $-2.6867$ | .0645 |
| $-.4149$ | .0502 | $-1.0426$ | $-2.7017$ | .0594 |
| $-.4449$ | .0459 | $-1.0109$ | $-2.7149$ | .0547 |
| $-.4773$ | .0410 | $-.9740$ | $-2.7294$ | .0494 |
| $-.5049$ | .0368 | $-.9402$ | $-2.7420$ | .0446 |
| $-.5286$ | .0332 | $-.9091$ | $-2.7529$ | .0404 |
| $-.5560$ | .0287 | $-.8700$ | $-2.7659$ | .0351 |
| $-.5780$ | .0250 | $-.8354$ | $-2.7767$ | .0306 |
| $-.5979$ | .0215 | $-.8011$ | $-2.7870$ | .0263 |
| $-.6163$ | .0180 | $-.7649$ | $-2.7974$ | .0218 |
| $-.6324$ | .0144 | $-.7274$ | $-2.8078$ | .0172 |
| $-.6433$ | .0112 | $-.6935$ | $-2.8172$ | .0130 |
| $-.6477$ | .0080 | $-.6631$ | $-2.8265$ | .0090 |
| $-.6385$ | .0049 | $-.6453$ | $-2.8358$ | .0050 |
| $-.5840$ | .0018 | $-.6981$ | $-2.8448$ | .0015 |
| .0000 | .0000 | $-6.2536$ | $-2.8498$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1145 | $-1.3834$ | $-2.5211$ |
| .0367 | $-.0467$ | .1083 | $-1.3534$ | $-2.5271$ |
| .0721 | $-.0897$ | .1025 | $-1.3245$ | $-2.5321$ |
| .1229 | $-.1482$ | .0946 | $-1.2829$ | $-2.5380$ |
| .1554 | $-.1836$ | .0897 | $-1.2564$ | $-2.5411$ |
| .2022 | $-.2319$ | .0829 | $-1.2184$ | $-2.5445$ |
| .2466 | $-.2751$ | .0768 | $-1.1824$ | $-2.5469$ |
| .2889 | $-.3139$ | .0712 | $-1.1482$ | $-2.5485$ |
| .3291 | $-.3488$ | .0661 | $-1.1158$ | $-2.5493$ |
| .3674 | $-.3802$ | .0614 | $-1.0851$ | $-2.5495$ |
| .4156 | $-.4173$ | .0558 | $-1.0467$ | $-2.5492$ |
| .4608 | $-.4498$ | .0508 | $-1.0109$ | $-2.5483$ |
| .5032 | $-.4782$ | .0464 | $-.9776$ | $-2.5470$ |
| .5527 | $-.5090$ | .0415 | $-.9393$ | $-2.5450$ |
| .5984 | $-.5351$ | .0372 | $-.9043$ | $-2.5428$ |
| .6408 | $-.5573$ | .0334 | $-.8724$ | $-2.5404$ |
| .6952 | $-.5831$ | .0290 | $-.8325$ | $-2.5371$ |
| .7443 | $-.6036$ | .0252 | $-.7975$ | $-2.5339$ |
| .7949 | $-.6220$ | .0217 | $-.7628$ | $-2.5305$ |
| .8510 | $-.6389$ | .0181 | $-.7265$ | $-2.5266$ |
| .9142 | $-.6532$ | .0144 | $-.6892$ | $-2.5224$ |
| .9801 | $-.6624$ | .0112 | $-.6555$ | $-2.5182$ |
| 1.0582 | $-.6648$ | .0080 | $-.6252$ | $-2.5139$ |
| 1.1624 | $-.6531$ | .0049 | $-.6070$ | $-2.5095$ |
| 1.3611 | $-.5948$ | .0018 | $-.6551$ | $-2.5054$ |
| 8.6892 | .0000 | .0000 | $-5.8615$ | $-2.5036$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| −20.6830 | −.1497 | .3233 |
| −19.8866 | −.1391 | .4655 |
| −19.1351 | −.1294 | .5970 |
| −18.0845 | −.1164 | .7763 |
| −17.4308 | −.1086 | .8851 |
| −16.5132 | −.0981 | 1.0339 |
| −15.6642 | −.0889 | 1.1673 |
| −14.8768 | −.0807 | 1.2871 |
| −14.1450 | −.0735 | 1.3950 |
| −13.4636 | −.0671 | 1.4921 |
| −12.6253 | −.0597 | 1.6071 |
| −11.8588 | −.0532 | 1.7075 |
| −11.1559 | −.0477 | 1.7954 |
| −10.3564 | −.0418 | 1.8901 |
| −9.6340 | −.0368 | 1.9708 |
| −8.9791 | −.0326 | 2.0395 |
| −8.1604 | −.0277 | 2.1193 |
| −7.4398 | −.0237 | 2.1836 |
| −6.7173 | −.0201 | 2.2423 |
| −5.9400 | −.0165 | 2.2986 |
| −5.0977 | −.0130 | 2.3516 |
| −4.2629 | −.0099 | 2.3955 |
| −3.3469 | −.0069 | 2.4341 |
| −2.2932 | −.0041 | 2.4663 |
| −.9759 | −.0013 | 2.4897 |
| .0000 | .0000 | 2.4974 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −15.6250 | −.4114 | 2.1721 | −.1535 |
| −15.0087 | −.3990 | 2.2054 | −.1676 |
| −14.4252 | −.3869 | 2.2346 | −.1791 |
| −13.6063 | −.3692 | 2.2715 | −.1922 |
| −13.0949 | −.3578 | 2.2920 | −.1985 |
| −12.3747 | −.3411 | 2.3177 | −.2051 |
| −11.7058 | −.3250 | 2.3380 | −.2087 |
| −11.0834 | −.3095 | 2.3538 | −.2100 |
| −10.5030 | −.2947 | 2.3657 | −.2093 |
| −9.9610 | −.2805 | 2.3744 | −.2072 |
| −9.2922 | −.2625 | 2.3818 | −.2025 |
| −8.6785 | −.2456 | 2.3854 | −.1963 |
| −8.1142 | −.2297 | 2.3860 | −.1890 |
| −7.4703 | −.2113 | 2.3836 | −.1791 |
| −6.8868 | −.1943 | 2.3786 | −.1687 |
| −6.3566 | −.1788 | 2.3719 | −.1581 |
| −5.6921 | −.1591 | 2.3608 | −.1436 |
| −5.1059 | −.1418 | 2.3486 | −.1297 |
| −4.5174 | −.1245 | 2.3343 | −.1151 |
| −3.8840 | −.1060 | 2.3172 | −.0988 |
| −3.1983 | −.0865 | 2.2969 | −.0808 |
| −2.5213 | −.0680 | 2.2760 | −.0631 |
| −1.7851 | −.0489 | 2.2530 | −.0446 |
| −.9561 | −.0294 | 2.2284 | −.0255 |
| .0116 | −.0099 | 2.2042 | −.0074 |
| .0000 | .0000 | 2.1940 | .0000 |

# tableaux 36

## n̂ = 0.8 et γ = 1.4

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9945 | .9840 | 1.0023 | .9941 |
| .9894 | .9685 | 1.0046 | .9886 |
| .9844 | .9534 | 1.0068 | .9833 |
| .9782 | .9341 | 1.0097 | .9768 |
| .9738 | .9200 | 1.0119 | .9722 |
| .9683 | .9020 | 1.0146 | .9664 |
| .9631 | .8845 | 1.0173 | .9611 |
| .9582 | .8677 | 1.0199 | .9561 |
| .9537 | .8515 | 1.0223 | .9515 |
| .9484 | .8319 | 1.0253 | .9461 |
| .9436 | .8131 | 1.0280 | .9412 |
| .9392 | .7951 | 1.0307 | .9368 |
| .9351 | .7778 | 1.0331 | .9327 |
| .9306 | .7579 | 1.0359 | .9283 |
| .9259 | .7357 | 1.0388 | .9237 |
| .9218 | .7147 | 1.0415 | .9197 |
| .9177 | .6920 | 1.0442 | .9157 |
| .9132 | .6653 | 1.0472 | .9115 |
| .9092 | .6380 | 1.0500 | .9077 |
| .9053 | .6082 | 1.0528 | .9042 |
| .9013 | .5728 | 1.0556 | .9008 |
| .8974 | .5289 | 1.0585 | .8975 |
| .8936 | .4710 | 1.0613 | .8946 |
| .8898 | .3694 | 1.0641 | .8921 |
| .8880 | .0382 | 1.0656 | .8912 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0078 | 1.0051 | $-.1871$ |
| 1.0154 | 1.0100 | $-.1750$ |
| 1.0228 | 1.0147 | $-.1638$ |
| 1.0322 | 1.0208 | $-.1499$ |
| 1.0391 | 1.0252 | $-.1404$ |
| 1.0479 | 1.0308 | $-.1286$ |
| 1.0563 | 1.0362 | $-.1179$ |
| 1.0643 | 1.0412 | $-.1081$ |
| 1.0719 | 1.0461 | $-.0992$ |
| 1.0810 | 1.0518 | $-.0891$ |
| 1.0895 | 1.0571 | $-.0800$ |
| 1.0974 | 1.0621 | $-.0719$ |
| 1.1048 | 1.0667 | $-.0647$ |
| 1.1131 | 1.0719 | $-.0570$ |
| 1.1219 | 1.0773 | $-.0493$ |
| 1.1298 | 1.0823 | $-.0426$ |
| 1.1379 | 1.0874 | $-.0362$ |
| 1.1467 | 1.0930 | $-.0296$ |
| 1.1549 | 1.0982 | $-.0238$ |
| 1.1629 | 1.1034 | $-.0185$ |
| 1.1712 | 1.1089 | $-.0134$ |
| 1.1796 | 1.1146 | $-.0087$ |
| 1.1877 | 1.1204 | $-.0046$ |
| 1.1959 | 1.1267 | $-.0012$ |
| 1.2000 | 1.1302 | $.0000$ |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0460 | .2237 | −1.5158 | −2.5223 | .2285 |
| −.0044 | .2115 | −1.4961 | −2.5658 | .2190 |
| −.0508 | .2001 | −1.4769 | −2.6065 | .2096 |
| −.0936 | .1894 | −1.4580 | −2.6447 | .2004 |
| −.1457 | .1760 | −1.4334 | −2.6920 | .1885 |
| −.1815 | .1667 | −1.4154 | −2.7249 | .1799 |
| −.2253 | .1552 | −1.3920 | −2.7658 | .1689 |
| −.2650 | .1445 | −1.3693 | −2.8036 | .1584 |
| −.3011 | .1346 | −1.3474 | −2.8384 | .1484 |
| −.3341 | .1254 | −1.3262 | −2.8707 | .1390 |
| −.3712 | .1149 | −1.3009 | −2.9075 | .1279 |
| −.4045 | .1054 | −1.2769 | −2.9410 | .1176 |
| −.4342 | .0967 | −1.2541 | −2.9713 | .1081 |
| −.4609 | .0888 | −1.2326 | −2.9989 | .0993 |
| −.4894 | .0802 | −1.2085 | −3.0287 | .0897 |
| −.5183 | .0714 | −1.1828 | −3.0594 | .0796 |
| −.5432 | .0636 | −1.1596 | −3.0864 | .0706 |
| −.5675 | .0558 | −1.1362 | −3.1131 | .0617 |
| −.5925 | .0476 | −1.1112 | −3.1414 | .0521 |
| −.6144 | .0401 | −1.0891 | −3.1670 | .0433 |
| −.6341 | .0330 | −1.0697 | −3.1914 | .0349 |
| −.6520 | .0258 | −1.0540 | −3.2158 | .0266 |
| −.6664 | .0186 | −1.0477 | −3.2400 | .0183 |
| −.6722 | .0116 | −1.0669 | −3.2631 | .0105 |
| −.6475 | .0043 | −1.2030 | −3.2858 | .0032 |
| .0000 | .0000 | −10.5923 | −3.2973 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .2303 | $-1.5158$ | $-2.5394$ |
| .0418 | $-.0489$ | .2169 | $-1.4880$ | $-2.5540$ |
| .0826 | $-.0938$ | .2043 | $-1.4612$ | $-2.5665$ |
| .1223 | $-.1353$ | .1927 | $-1.4353$ | $-2.5773$ |
| .1738 | $-.1858$ | .1783 | $-1.4021$ | $-2.5892$ |
| .2112 | $-.2204$ | .1683 | $-1.3783$ | $-2.5967$ |
| .2598 | $-.2627$ | .1560 | $-1.3478$ | $-2.6048$ |
| .3068 | $-.3011$ | .1447 | $-1.3188$ | $-2.6114$ |
| .3523 | $-.3360$ | .1343 | $-1.2911$ | $-2.6165$ |
| .3964 | $-.3677$ | .1247 | $-1.2648$ | $-2.6204$ |
| .4496 | $-.4035$ | .1138 | $-1.2339$ | $-2.6241$ |
| .5007 | $-.4355$ | .1040 | $-1.2049$ | $-2.6265$ |
| .5498 | $-.4641$ | .0951 | $-1.1778$ | $-2.6280$ |
| .5971 | $-.4897$ | .0871 | $-1.1526$ | $-2.6287$ |
| .6515 | $-.5170$ | .0784 | $-1.1247$ | $-2.6288$ |
| .7118 | $-.5446$ | .0695 | $-1.0952$ | $-2.6283$ |
| .7691 | $-.5683$ | .0617 | $-1.0690$ | $-2.6272$ |
| .8311 | $-.5914$ | .0540 | $-1.0426$ | $-2.6255$ |
| .9037 | $-.6150$ | .0459 | $-1.0148$ | $-2.6232$ |
| .9781 | $-.6356$ | .0386 | $-.9902$ | $-2.6205$ |
| 1.0593 | $-.6540$ | .0316 | $-.9683$ | $-2.6174$ |
| 1.1564 | $-.6705$ | .0246 | $-.9500$ | $-2.6139$ |
| 1.2795 | $-.6831$ | .0176 | $-.9402$ | $-2.6101$ |
| 1.4505 | $-.6869$ | .0109 | $-.9534$ | $-2.6060$ |
| 1.8086 | $-.6589$ | .0041 | $-1.0705$ | $-2.6018$ |
| 14.6244 | .0000 | .0000 | $-9.4057$ | $-2.5999$ |

**Ecoulement d'ordre 2
effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-9.9341$ | $-.1683$ | $1.1710$ |
| $-9.5350$ | $-.1571$ | $1.2546$ |
| $-9.1567$ | $-.1468$ | $1.3328$ |
| $-8.7977$ | $-.1373$ | $1.4061$ |
| $-8.3463$ | $-.1258$ | $1.4969$ |
| $-8.0267$ | $-.1179$ | $1.5602$ |
| $-7.6238$ | $-.1083$ | $1.6388$ |
| $-7.2453$ | $-.0996$ | $1.7112$ |
| $-6.8892$ | $-.0916$ | $1.7780$ |
| $-6.5539$ | $-.0845$ | $1.8396$ |
| $-6.1615$ | $-.0764$ | $1.9100$ |
| $-5.7964$ | $-.0692$ | $1.9735$ |
| $-5.4562$ | $-.0627$ | $2.0310$ |
| $-5.1389$ | $-.0570$ | $2.0829$ |
| $-4.7858$ | $-.0509$ | $2.1385$ |
| $-4.4084$ | $-.0447$ | $2.1952$ |
| $-4.0644$ | $-.0393$ | $2.2443$ |
| $-3.7080$ | $-.0341$ | $2.2922$ |
| $-3.3109$ | $-.0287$ | $2.3418$ |
| $-2.9281$ | $-.0238$ | $2.3855$ |
| $-2.5379$ | $-.0193$ | $2.4257$ |
| $-2.1115$ | $-.0147$ | $2.4642$ |
| $-1.6367$ | $-.0103$ | $2.5001$ |
| $-1.1019$ | $-.0061$ | $2.5317$ |
| $-.4052$ | $-.0020$ | $2.5588$ |
| $.0000$ | $.0000$ | $2.5701$ |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-7.8125$ | $-.4714$ | $1.9590$ | $-.2910$ |
| $-7.4832$ | $-.4551$ | $1.9836$ | $-.2975$ |
| $-7.1703$ | $-.4391$ | $2.0054$ | $-.3015$ |
| $-6.8725$ | $-.4234$ | $2.0247$ | $-.3033$ |
| $-6.4974$ | $-.4030$ | $2.0467$ | $-.3029$ |
| $-6.2313$ | $-.3882$ | $2.0609$ | $-.3009$ |
| $-5.8952$ | $-.3689$ | $2.0768$ | $-.2963$ |
| $-5.5790$ | $-.3504$ | $2.0898$ | $-.2899$ |
| $-5.2812$ | $-.3325$ | $2.1003$ | $-.2822$ |
| $-5.0003$ | $-.3152$ | $2.1085$ | $-.2735$ |
| $-4.6713$ | $-.2947$ | $2.1161$ | $-.2616$ |
| $-4.3648$ | $-.2752$ | $2.1212$ | $-.2489$ |
| $-4.0789$ | $-.2568$ | $2.1241$ | $-.2359$ |
| $-3.8120$ | $-.2394$ | $2.1254$ | $-.2228$ |
| $-3.5147$ | $-.2198$ | $2.1251$ | $-.2071$ |
| $-3.1966$ | $-.1988$ | $2.1228$ | $-.1894$ |
| $-2.9065$ | $-.1797$ | $2.1192$ | $-.1726$ |
| $-2.6057$ | $-.1599$ | $2.1138$ | $-.1545$ |
| $-2.2705$ | $-.1381$ | $2.1062$ | $-.1341$ |
| $-1.9474$ | $-.1175$ | $2.0974$ | $-.1142$ |
| $-1.6184$ | $-.0972$ | $2.0874$ | $-.0943$ |
| $-1.2599$ | $-.0761$ | $2.0756$ | $-.0732$ |
| $-.8635$ | $-.0543$ | $2.0622$ | $-.0514$ |
| $-.4239$ | $-.0327$ | $2.0479$ | $-.0298$ |
| $.1190$ | $-.0110$ | $2.0331$ | $-.0089$ |
| $.0000$ | $.0000$ | $2.0265$ | $.0000$ |

# tableaux 37

## $\hat{n} = 0.85$ et $\gamma = 1.2$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9968 | .9856 | 1.0018 | .9955 |
| .9937 | .9715 | 1.0036 | .9913 |
| .9908 | .9578 | 1.0053 | .9872 |
| .9880 | .9444 | 1.0070 | .9834 |
| .9854 | .9314 | 1.0085 | .9798 |
| .9830 | .9186 | 1.0100 | .9763 |
| .9806 | .9062 | 1.0115 | .9731 |
| .9784 | .8940 | 1.0129 | .9700 |
| .9754 | .8764 | 1.0148 | .9658 |
| .9735 | .8649 | 1.0161 | .9631 |
| .9709 | .8482 | 1.0178 | .9594 |
| .9685 | .8322 | 1.0194 | .9561 |
| .9663 | .8166 | 1.0209 | .9530 |
| .9643 | .8016 | 1.0223 | .9503 |
| .9619 | .7824 | 1.0239 | .9470 |
| .9593 | .7595 | 1.0258 | .9434 |
| .9575 | .7421 | 1.0271 | .9410 |
| .9551 | .7173 | 1.0287 | .9379 |
| .9529 | .6903 | 1.0304 | .9351 |
| .9508 | .6583 | 1.0320 | .9323 |
| .9486 | .6199 | 1.0336 | .9297 |
| .9465 | .5646 | 1.0352 | .9272 |
| .9444 | .4662 | 1.0368 | .9250 |
| .9433 | .0303 | 1.0376 | .9242 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | $-.1000$ |
| 1.0051 | 1.0020 | $-.0929$ |
| 1.0100 | 1.0039 | $-.0863$ |
| 1.0147 | 1.0057 | $-.0802$ |
| 1.0192 | 1.0074 | $-.0745$ |
| 1.0235 | 1.0090 | $-.0692$ |
| 1.0276 | 1.0105 | $-.0643$ |
| 1.0315 | 1.0119 | $-.0597$ |
| 1.0352 | 1.0132 | $-.0555$ |
| 1.0404 | 1.0151 | $-.0497$ |
| 1.0437 | 1.0163 | $-.0461$ |
| 1.0484 | 1.0179 | $-.0413$ |
| 1.0526 | 1.0194 | $-.0370$ |
| 1.0566 | 1.0208 | $-.0331$ |
| 1.0602 | 1.0220 | $-.0297$ |
| 1.0646 | 1.0236 | $-.0257$ |
| 1.0694 | 1.0253 | $-.0214$ |
| 1.0727 | 1.0265 | $-.0186$ |
| 1.0771 | 1.0281 | $-.0150$ |
| 1.0812 | 1.0297 | $-.0118$ |
| 1.0854 | 1.0314 | $-.0087$ |
| 1.0895 | 1.0331 | $-.0058$ |
| 1.0938 | 1.0350 | $-.0031$ |
| 1.0979 | 1.0372 | $-.0009$ |
| 1.1000 | 1.0386 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0839 | .0844 | −1.3132 | −2.3716 | .1119 |
| .0454 | .0783 | −1.2821 | −2.3950 | .1055 |
| .0097 | .0726 | −1.2516 | −2.4167 | .0993 |
| −.0237 | .0673 | −1.2218 | −2.4366 | .0934 |
| −.0547 | .0624 | −1.1927 | −2.4551 | .0878 |
| −.0837 | .0579 | −1.1642 | −2.4722 | .0826 |
| −.1108 | .0538 | −1.1365 | −2.4880 | .0776 |
| −.1362 | .0499 | −1.1095 | −2.5026 | .0728 |
| −.1600 | .0463 | −1.0833 | −2.5161 | .0684 |
| −.1929 | .0415 | −1.0454 | −2.5345 | .0622 |
| −.2131 | .0385 | −1.0211 | −2.5457 | .0583 |
| −.2413 | .0345 | −.9860 | −2.5610 | .0530 |
| −.2669 | .0310 | −.9527 | −2.5746 | .0481 |
| −.2903 | .0278 | −.9210 | −2.5869 | .0437 |
| −.3118 | .0250 | −.8910 | −2.5978 | .0397 |
| −.3375 | .0217 | −.8537 | −2.6106 | .0350 |
| −.3658 | .0182 | −.8109 | −2.6242 | .0298 |
| −.3856 | .0159 | −.7798 | −2.6335 | .0263 |
| −.4114 | .0130 | −.7379 | −2.6451 | .0218 |
| −.4365 | .0104 | −.6957 | −2.6560 | .0175 |
| −.4621 | .0079 | −.6509 | −2.6666 | .0133 |
| −.4874 | .0055 | −.6051 | −2.6766 | .0094 |
| −.5136 | .0032 | −.5563 | −2.6867 | .0054 |
| −.5317 | .0011 | −.5231 | −2.6963 | .0017 |
| .0000 | .0000 | −6.2710 | −2.7011 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0951 | −1.3132 | −2.3980 |
| .0431 | −.0360 | .0883 | −1.2780 | −2.4045 |
| .0850 | −.0693 | .0820 | −1.2437 | −2.4098 |
| .1257 | −.1004 | .0762 | −1.2105 | −2.4142 |
| .1651 | −.1292 | .0708 | −1.1784 | −2.4177 |
| .2035 | −.1562 | .0658 | −1.1473 | −2.4204 |
| .2406 | −.1813 | .0611 | −1.1172 | −2.4226 |
| .2766 | −.2048 | .0568 | −1.0881 | −2.4242 |
| .3115 | −.2268 | .0529 | −1.0600 | −2.4254 |
| .3618 | −.2571 | .0475 | −1.0197 | −2.4265 |
| .3941 | −.2758 | .0442 | −.9940 | −2.4268 |
| .4404 | −.3017 | .0397 | −.9573 | −2.4269 |
| .4846 | −.3253 | .0357 | −.9226 | −2.4266 |
| .5266 | −.3467 | .0321 | −.8899 | −2.4259 |
| .5665 | −.3663 | .0290 | −.8592 | −2.4251 |
| .6166 | −.3899 | .0252 | −.8211 | −2.4238 |
| .6746 | −.4156 | .0213 | −.7779 | −2.4220 |
| .7176 | −.4337 | .0187 | −.7466 | −2.4205 |
| .7767 | −.4571 | .0154 | −.7048 | −2.4184 |
| .8387 | −.4796 | .0123 | −.6629 | −2.4161 |
| .9085 | −.5026 | .0093 | −.6188 | −2.4135 |
| .9878 | −.5249 | .0066 | −.5740 | −2.4108 |
| 1.0938 | −.5472 | .0039 | −.5265 | −2.4079 |
| 1.2714 | −.5590 | .0013 | −.4940 | −2.4049 |
| 12.2333 | .0000 | .0000 | −5.9155 | −2.4035 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-16.8264$ | $-.0806$ | .7876 |
| $-16.2827$ | $-.0735$ | .8760 |
| $-15.7612$ | $-.0670$ | .9589 |
| $-15.2606$ | $-.0612$ | 1.0365 |
| $-14.7799$ | $-.0559$ | 1.1092 |
| $-14.3182$ | $-.0510$ | 1.1772 |
| $-13.8746$ | $-.0466$ | 1.2408 |
| $-13.4482$ | $-.0427$ | 1.3002 |
| $-13.0383$ | $-.0391$ | 1.3558 |
| $-12.4525$ | $-.0343$ | 1.4321 |
| $-12.0805$ | $-.0314$ | 1.4787 |
| $-11.5485$ | $-.0277$ | 1.5427 |
| $-11.0460$ | $-.0244$ | 1.6000 |
| $-10.5711$ | $-.0216$ | 1.6514 |
| $-10.1220$ | $-.0191$ | 1.6974 |
| $-9.5606$ | $-.0163$ | 1.7511 |
| $-8.9138$ | $-.0135$ | 1.8076 |
| $-8.4366$ | $-.0116$ | 1.8456 |
| $-7.7808$ | $-.0094$ | 1.8925 |
| $-7.0968$ | $-.0074$ | 1.9349 |
| $-6.3278$ | $-.0055$ | 1.9748 |
| $-5.4627$ | $-.0038$ | 2.0103 |
| $-4.3342$ | $-.0022$ | 2.0430 |
| $-2.6587$ | $-.0007$ | 2.0688 |
| .0000 | .0000 | 2.0777 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-13.8408$ | $-.4629$ | $1.7270$ | $-.1362$ |
| $-13.3863$ | $-.4405$ | $1.7584$ | $-.1435$ |
| $-12.9498$ | $-.4188$ | $1.7858$ | $-.1489$ |
| $-12.5303$ | $-.3981$ | $1.8098$ | $-.1526$ |
| $-12.1270$ | $-.3782$ | $1.8306$ | $-.1549$ |
| $-11.7390$ | $-.3590$ | $1.8484$ | $-.1558$ |
| $-11.3658$ | $-.3407$ | $1.8638$ | $-.1557$ |
| $-11.0064$ | $-.3232$ | $1.8768$ | $-.1547$ |
| $-10.6604$ | $-.3064$ | $1.8877$ | $-.1529$ |
| $-10.1650$ | $-.2826$ | $1.9008$ | $-.1491$ |
| $-9.8497$ | $-.2677$ | $1.9075$ | $-.1459$ |
| $-9.3978$ | $-.2466$ | $1.9151$ | $-.1404$ |
| $-8.9698$ | $-.2270$ | $1.9203$ | $-.1344$ |
| $-8.5641$ | $-.2088$ | $1.9234$ | $-.1279$ |
| $-8.1795$ | $-.1920$ | $1.9248$ | $-.1213$ |
| $-7.6972$ | $-.1716$ | $1.9248$ | $-.1123$ |
| $-7.1395$ | $-.1490$ | $1.9225$ | $-.1012$ |
| $-6.7265$ | $-.1331$ | $1.9194$ | $-.0928$ |
| $-6.1570$ | $-.1124$ | $1.9137$ | $-.0809$ |
| $-5.5607$ | $-.0923$ | $1.9063$ | $-.0685$ |
| $-4.8880$ | $-.0719$ | $1.8968$ | $-.0550$ |
| $-4.1294$ | $-.0520$ | $1.8857$ | $-.0408$ |
| $-3.1401$ | $-.0310$ | $1.8721$ | $-.0249$ |
| $-1.6874$ | $-.0104$ | $1.8568$ | $-.0083$ |
| $.0000$ | $.0000$ | $1.8489$ | $.0000$ |

# tableaux 38

## $\hat{n} = 0.85$ et $\gamma = 1.4$

Ecoulement de base

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9959 | .9924 | 1.0027 | .9982 |
| .9918 | .9847 | 1.0052 | .9964 |
| .9861 | .9733 | 1.0090 | .9937 |
| .9824 | .9657 | 1.0115 | .9919 |
| .9771 | .9544 | 1.0150 | .9892 |
| .9720 | .9431 | 1.0185 | .9866 |
| .9673 | .9319 | 1.0218 | .9840 |
| .9627 | .9207 | 1.0250 | .9814 |
| .9585 | .9097 | 1.0280 | .9789 |
| .9544 | .8987 | 1.0310 | .9765 |
| .9506 | .8878 | 1.0337 | .9741 |
| .9458 | .8735 | 1.0373 | .9711 |
| .9414 | .8593 | 1.0406 | .9683 |
| .9374 | .8453 | 1.0437 | .9656 |
| .9337 | .8316 | 1.0466 | .9631 |
| .9294 | .8147 | 1.0499 | .9602 |
| .9257 | .7982 | 1.0529 | .9576 |
| .9217 | .7789 | 1.0561 | .9547 |
| .9177 | .7571 | 1.0594 | .9519 |
| .9139 | .7331 | 1.0626 | .9492 |
| .9102 | .7046 | 1.0657 | .9465 |
| .9063 | .6674 | 1.0691 | .9438 |
| .9028 | .6195 | 1.0721 | .9413 |
| .8992 | .5262 | 1.0753 | .9390 |
| .8974 | .0394 | 1.0769 | .9381 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|----------|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0068 | 1.0065 | $-.1901$ |
| 1.0135 | 1.0129 | $-.1807$ |
| 1.0233 | 1.0220 | $-.1672$ |
| 1.0296 | 1.0278 | $-.1588$ |
| 1.0389 | 1.0362 | $-.1468$ |
| 1.0478 | 1.0442 | $-.1357$ |
| 1.0564 | 1.0517 | $-.1252$ |
| 1.0646 | 1.0588 | $-.1155$ |
| 1.0726 | 1.0656 | $-.1065$ |
| 1.0802 | 1.0720 | $-.0981$ |
| 1.0875 | 1.0781 | $-.0903$ |
| 1.0967 | 1.0856 | $-.0807$ |
| 1.1053 | 1.0925 | $-.0721$ |
| 1.1134 | 1.0989 | $-.0643$ |
| 1.1210 | 1.1048 | $-.0573$ |
| 1.1296 | 1.1115 | $-.0495$ |
| 1.1375 | 1.1175 | $-.0428$ |
| 1.1459 | 1.1239 | $-.0358$ |
| 1.1544 | 1.1302 | $-.0291$ |
| 1.1626 | 1.1363 | $-.0229$ |
| 1.1709 | 1.1425 | $-.0170$ |
| 1.1795 | 1.1489 | $-.0112$ |
| 1.1875 | 1.1549 | $-.0063$ |
| 1.1959 | 1.1613 | $-.0018$ |
| 1.2000 | 1.1648 | $.0000$ |

Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0622 | .1731 | −1.4461 | −2.4192 | .2299 |
| .0376 | .1651 | −1.4319 | −2.4503 | .2207 |
| .0141 | .1574 | −1.4176 | −2.4801 | .2118 |
| −.0193 | .1465 | −1.3962 | −2.5226 | .1988 |
| −.0404 | .1397 | −1.3819 | −2.5495 | .1904 |
| −.0705 | .1299 | −1.3605 | −2.5878 | .1784 |
| −.0989 | .1208 | −1.3391 | −2.6239 | .1669 |
| −.1256 | .1122 | −1.3179 | −2.6578 | .1560 |
| −.1508 | .1042 | −1.2968 | −2.6896 | .1456 |
| −.1746 | .0967 | −1.2760 | −2.7195 | .1358 |
| −.1971 | .0897 | −1.2554 | −2.7475 | .1265 |
| −.2184 | .0832 | −1.2351 | −2.7738 | .1177 |
| −.2450 | .0751 | −1.2086 | −2.8062 | .1068 |
| −.2698 | .0678 | −1.1828 | −2.8360 | .0968 |
| −.2928 | .0611 | −1.1579 | −2.8631 | .0876 |
| −.3143 | .0550 | −1.1339 | −2.8879 | .0791 |
| −.3391 | .0483 | −1.1054 | −2.9157 | .0696 |
| −.3618 | .0423 | −1.0785 | −2.9404 | .0611 |
| −.3864 | .0361 | −1.0487 | −2.9663 | .0522 |
| −.4120 | .0300 | −1.0174 | −2.9920 | .0434 |
| −.4375 | .0242 | −.9863 | −3.0161 | .0351 |
| −.4645 | .0187 | −.9544 | −3.0400 | .0269 |
| −.4945 | .0130 | −.9220 | −3.0642 | .0185 |
| −.5250 | .0080 | −.8973 | −3.0861 | .0110 |
| −.5597 | .0028 | −.9103 | −3.1086 | .0035 |
| .0000 | .0000 | −10.5395 | −3.1195 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1949 | −1.4461 | −2.4337 |
| .0303 | −.0240 | .1856 | −1.4259 | −2.4445 |
| .0604 | −.0469 | .1767 | −1.4061 | −2.4542 |
| .1051 | −.0793 | .1641 | −1.3768 | −2.4670 |
| .1345 | −.0998 | .1562 | −1.3576 | −2.4745 |
| .1782 | −.1289 | .1450 | −1.3293 | −2.4843 |
| .2214 | −.1561 | .1346 | −1.3017 | −2.4926 |
| .2639 | −.1817 | .1249 | −1.2748 | −2.4996 |
| .3058 | −.2059 | .1158 | −1.2485 | −2.5055 |
| .3472 | −.2286 | .1074 | −1.2230 | −2.5103 |
| .3879 | −.2500 | .0995 | −1.1981 | −2.5143 |
| .4280 | −.2702 | .0922 | −1.1740 | −2.5175 |
| .4804 | −.2954 | .0832 | −1.1431 | −2.5208 |
| .5317 | −.3188 | .0750 | −1.1135 | −2.5231 |
| .5817 | −.3405 | .0676 | −1.0854 | −2.5247 |
| .6306 | −.3607 | .0609 | −1.0587 | −2.5257 |
| .6900 | −.3839 | .0534 | −1.0274 | −2.5262 |
| .7475 | −.4051 | .0467 | −.9984 | −2.5262 |
| .8139 | −.4281 | .0399 | −.9666 | −2.5257 |
| .8880 | −.4519 | .0331 | −.9337 | −2.5247 |
| .9682 | −.4756 | .0268 | −.9014 | −2.5233 |
| 1.0621 | −.5005 | .0206 | −.8687 | −2.5215 |
| 1.1827 | −.5280 | .0144 | −.8356 | −2.5192 |
| 1.3367 | −.5556 | .0088 | −.8101 | −2.5167 |
| 1.6467 | −.5853 | .0030 | −.8186 | −2.5138 |
| 20.5319 | .0000 | .0000 | −9.4585 | −2.5124 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|:-----------:|:--------:|:--------:|
| $-8.1046$ | $-.0847$ | $1.2937$ |
| $-7.9450$ | $-.0808$ | $1.3239$ |
| $-7.7875$ | $-.0770$ | $1.3536$ |
| $-7.5552$ | $-.0717$ | $1.3974$ |
| $-7.4031$ | $-.0682$ | $1.4260$ |
| $-7.1790$ | $-.0633$ | $1.4679$ |
| $-6.9599$ | $-.0587$ | $1.5084$ |
| $-6.7458$ | $-.0543$ | $1.5476$ |
| $-6.5368$ | $-.0502$ | $1.5854$ |
| $-6.3328$ | $-.0464$ | $1.6217$ |
| $-6.1338$ | $-.0429$ | $1.6564$ |
| $-5.9399$ | $-.0395$ | $1.6895$ |
| $-5.6891$ | $-.0355$ | $1.7313$ |
| $-5.4473$ | $-.0318$ | $1.7702$ |
| $-5.2142$ | $-.0285$ | $1.8062$ |
| $-4.9898$ | $-.0255$ | $1.8395$ |
| $-4.7214$ | $-.0222$ | $1.8774$ |
| $-4.4662$ | $-.0193$ | $1.9112$ |
| $-4.1769$ | $-.0163$ | $1.9468$ |
| $-3.8621$ | $-.0134$ | $1.9821$ |
| $-3.5307$ | $-.0108$ | $2.0152$ |
| $-3.1567$ | $-.0082$ | $2.0474$ |
| $-2.7011$ | $-.0056$ | $2.0793$ |
| $-2.1689$ | $-.0034$ | $2.1069$ |
| $-1.3058$ | $-.0011$ | $2.1329$ |
| $.0000$ | $.0000$ | $2.1435$ |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-6.9204$ | $-.5007$ | $1.5690$ | $-.2612$ |
| $-6.7720$ | $-.4839$ | $1.5879$ | $-.2598$ |
| $-6.6262$ | $-.4674$ | $1.6055$ | $-.2579$ |
| $-6.4124$ | $-.4435$ | $1.6294$ | $-.2539$ |
| $-6.2731$ | $-.4280$ | $1.6438$ | $-.2507$ |
| $-6.0687$ | $-.4054$ | $1.6633$ | $-.2450$ |
| $-5.8699$ | $-.3837$ | $1.6804$ | $-.2386$ |
| $-5.6763$ | $-.3627$ | $1.6954$ | $-.2315$ |
| $-5.4880$ | $-.3426$ | $1.7084$ | $-.2238$ |
| $-5.3048$ | $-.3232$ | $1.7196$ | $-.2158$ |
| $-5.1265$ | $-.3045$ | $1.7292$ | $-.2075$ |
| $-4.9532$ | $-.2867$ | $1.7372$ | $-.1990$ |
| $-4.7294$ | $-.2640$ | $1.7459$ | $-.1874$ |
| $-4.5139$ | $-.2427$ | $1.7525$ | $-.1759$ |
| $-4.3064$ | $-.2226$ | $1.7574$ | $-.1644$ |
| $-4.1068$ | $-.2039$ | $1.7608$ | $-.1531$ |
| $-3.8681$ | $-.1822$ | $1.7633$ | $-.1395$ |
| $-3.6410$ | $-.1625$ | $1.7642$ | $-.1266$ |
| $-3.3834$ | $-.1412$ | $1.7639$ | $-.1120$ |
| $-3.1027$ | $-.1194$ | $1.7621$ | $-.0965$ |
| $-2.8068$ | $-.0983$ | $1.7589$ | $-.0809$ |
| $-2.4721$ | $-.0768$ | $1.7543$ | $-.0644$ |
| $-2.0638$ | $-.0543$ | $1.7479$ | $-.0464$ |
| $-1.5868$ | $-.0333$ | $1.7405$ | $-.0288$ |
| $-.8194$ | $-.0110$ | $1.7312$ | $-.0095$ |
| $.0000$ | $.0000$ | $1.7263$ | $.0000$ |

# tableaux 39

## $\hat{n} = 0.9$ et $\gamma = 1.2$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9959 | .9897 | 1.0031 | .9980 |
| .9921 | .9793 | 1.0061 | .9959 |
| .9884 | .9688 | 1.0089 | .9938 |
| .9850 | .9582 | 1.0115 | .9917 |
| .9818 | .9475 | 1.0140 | .9896 |
| .9789 | .9369 | 1.0164 | .9875 |
| .9761 | .9263 | 1.0186 | .9855 |
| .9736 | .9156 | 1.0207 | .9836 |
| .9712 | .9051 | 1.0226 | .9817 |
| .9690 | .8946 | 1.0244 | .9800 |
| .9670 | .8841 | 1.0260 | .9783 |
| .9652 | .8738 | 1.0276 | .9768 |
| .9635 | .8636 | 1.0290 | .9754 |
| .9612 | .8484 | 1.0309 | .9734 |
| .9587 | .8287 | 1.0331 | .9711 |
| .9571 | .8143 | 1.0344 | .9697 |
| .9549 | .7910 | 1.0363 | .9678 |
| .9527 | .7600 | 1.0382 | .9658 |
| .9509 | .7229 | 1.0399 | .9641 |
| .9488 | .6446 | 1.0417 | .9624 |
| .9478 | .0312 | 1.0426 | .9616 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | $-.1000$ |
| 1.0072 | 1.0062 | $-.0911$ |
| 1.0141 | 1.0119 | $-.0828$ |
| 1.0207 | 1.0172 | $-.0751$ |
| 1.0269 | 1.0221 | $-.0680$ |
| 1.0328 | 1.0265 | $-.0614$ |
| 1.0383 | 1.0306 | $-.0554$ |
| 1.0435 | 1.0343 | $-.0499$ |
| 1.0484 | 1.0377 | $-.0448$ |
| 1.0529 | 1.0408 | $-.0402$ |
| 1.0571 | 1.0436 | $-.0360$ |
| 1.0610 | 1.0462 | $-.0322$ |
| 1.0647 | 1.0485 | $-.0288$ |
| 1.0680 | 1.0507 | $-.0257$ |
| 1.0724 | 1.0535 | $-.0216$ |
| 1.0775 | 1.0566 | $-.0171$ |
| 1.0808 | 1.0586 | $-.0143$ |
| 1.0852 | 1.0612 | $-.0107$ |
| 1.0898 | 1.0640 | $-.0071$ |
| 1.0936 | 1.0663 | $-.0042$ |
| 1.0979 | 1.0690 | $-.0012$ |
| 1.1000 | 1.0704 | $.0000$ |

### Ecoulement d'ordre 1 du courant

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0607 | .0643 | −1.2473 | −2.2662 | .1103 |
| .0340 | .0579 | −1.2096 | −2.2933 | .1009 |
| .0088 | .0520 | −1.1721 | −2.3182 | .0922 |
| −.0152 | .0467 | −1.1349 | −2.3411 | .0840 |
| −.0378 | .0418 | −1.0981 | −2.3621 | .0764 |
| −.0593 | .0373 | −1.0618 | −2.3813 | .0694 |
| −.0798 | .0333 | −1.0261 | −2.3989 | .0629 |
| −.0992 | .0297 | −.9911 | −2.4150 | .0569 |
| −.1177 | .0264 | −.9570 | −2.4297 | .0514 |
| −.1352 | .0234 | −.9238 | −2.4431 | .0464 |
| −.1519 | .0208 | −.8915 | −2.4553 | .0417 |
| −.1678 | .0184 | −.8603 | −2.4663 | .0376 |
| −.1829 | .0163 | −.8303 | −2.4763 | .0337 |
| −.1973 | .0144 | −.8015 | −2.4854 | .0303 |
| −.2176 | .0120 | −.7605 | −2.4974 | .0257 |
| −.2423 | .0094 | −.7104 | −2.5107 | .0207 |
| −.2592 | .0078 | −.6761 | −2.5190 | .0175 |
| −.2847 | .0058 | −.6253 | −2.5301 | .0133 |
| −.3153 | .0038 | −.5666 | −2.5413 | .0090 |
| −.3472 | .0023 | −.5099 | −2.5506 | .0055 |
| −.3996 | .0007 | −.4349 | −2.5606 | .0018 |
| .0000 | .0000 | −6.3102 | −2.5655 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0833 | −1.2473 | −2.2779 |
| .0521 | −.0262 | .0753 | −1.2047 | −2.2865 |
| .1035 | −.0507 | .0680 | −1.1628 | −2.2934 |
| .1539 | −.0738 | .0613 | −1.1218 | −2.2990 |
| .2034 | −.0955 | .0552 | −1.0817 | −2.3034 |
| .2520 | −.1160 | .0496 | −1.0425 | −2.3067 |
| .2994 | −.1353 | .0445 | −1.0044 | −2.3093 |
| .3457 | −.1536 | .0399 | −.9675 | −2.3112 |
| .3909 | −.1709 | .0357 | −.9317 | −2.3125 |
| .4348 | −.1873 | .0320 | −.8972 | −2.3133 |
| .4774 | −.2029 | .0285 | −.8639 | −2.3138 |
| .5187 | −.2177 | .0255 | −.8320 | −2.3140 |
| .5587 | −.2317 | .0227 | −.8014 | −2.3139 |
| .5973 | −.2450 | .0202 | −.7722 | −2.3137 |
| .6526 | −.2637 | .0170 | −.7311 | −2.3132 |
| .7217 | −.2866 | .0135 | −.6810 | −2.3123 |
| .7699 | −.3023 | .0113 | −.6471 | −2.3116 |
| .8440 | −.3258 | .0085 | −.5971 | −2.3103 |
| .9353 | −.3541 | .0057 | −.5399 | −2.3088 |
| 1.0347 | −.3835 | .0034 | −.4848 | −2.3074 |
| 1.2173 | −.4314 | .0011 | −.4126 | −2.3056 |
| 23.3403 | .0000 | .0000 | −5.9809 | −2.3047 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-13.8144$ | $-.0351$ | $1.0966$ |
| $-13.4905$ | $-.0318$ | $1.1375$ |
| $-13.1668$ | $-.0287$ | $1.1786$ |
| $-12.8445$ | $-.0257$ | $1.2192$ |
| $-12.5244$ | $-.0229$ | $1.2591$ |
| $-12.2074$ | $-.0204$ | $1.2977$ |
| $-11.8941$ | $-.0181$ | $1.3350$ |
| $-11.5852$ | $-.0160$ | $1.3705$ |
| $-11.2813$ | $-.0141$ | $1.4043$ |
| $-10.9827$ | $-.0124$ | $1.4360$ |
| $-10.6899$ | $-.0109$ | $1.4658$ |
| $-10.4032$ | $-.0096$ | $1.4934$ |
| $-10.1229$ | $-.0084$ | $1.5190$ |
| $-9.8492$ | $-.0074$ | $1.5425$ |
| $-9.4513$ | $-.0061$ | $1.5740$ |
| $-8.9449$ | $-.0047$ | $1.6096$ |
| $-8.5834$ | $-.0039$ | $1.6318$ |
| $-8.0155$ | $-.0029$ | $1.6617$ |
| $-7.2906$ | $-.0019$ | $1.6913$ |
| $-6.4703$ | $-.0011$ | $1.7150$ |
| $-4.9052$ | $-.0004$ | $1.7387$ |
| $.0000$ | $.0000$ | $1.7479$ |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −12.3457 | −.4941 | 1.3781 | −.1212 |
| −12.0344 | −.4581 | 1.4158 | −.1217 |
| −11.7279 | −.4241 | 1.4483 | −.1210 |
| −11.4262 | −.3919 | 1.4761 | −.1194 |
| −11.1294 | −.3614 | 1.4997 | −.1168 |
| −10.8377 | −.3327 | 1.5195 | −.1135 |
| −10.5511 | −.3056 | 1.5361 | −.1096 |
| −10.2696 | −.2803 | 1.5497 | −.1053 |
| −9.9935 | −.2565 | 1.5608 | −.1006 |
| −9.7228 | −.2343 | 1.5697 | −.0956 |
| −9.4576 | −.2136 | 1.5766 | −.0905 |
| −9.1979 | −.1944 | 1.5820 | −.0853 |
| −8.9439 | −.1767 | 1.5860 | −.0801 |
| −8.6957 | −.1603 | 1.5888 | −.0750 |
| −8.3343 | −.1382 | 1.5913 | −.0675 |
| −7.8729 | −.1130 | 1.5924 | −.0581 |
| −7.5424 | −.0969 | 1.5920 | −.0516 |
| −7.0212 | −.0747 | 1.5901 | −.0420 |
| −6.3525 | −.0518 | 1.5864 | −.0310 |
| −5.5919 | −.0325 | 1.5818 | −.0206 |
| −4.1354 | −.0108 | 1.5747 | −.0075 |
| .0000 | .0000 | 1.5703 | .0000 |

# tableaux 40

## n̂ = 0.9 et γ = 1.4

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|---------|---------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9953 | .9959 | 1.0039 | 1.0007 |
| .9908 | .9916 | 1.0077 | 1.0012 |
| .9863 | .9871 | 1.0114 | 1.0015 |
| .9820 | .9824 | 1.0150 | 1.0016 |
| .9779 | .9775 | 1.0186 | 1.0016 |
| .9739 | .9725 | 1.0220 | 1.0014 |
| .9681 | .9646 | 1.0269 | 1.0010 |
| .9645 | .9592 | 1.0301 | 1.0006 |
| .9609 | .9536 | 1.0332 | 1.0001 |
| .9559 | .9451 | 1.0376 | .9991 |
| .9527 | .9392 | 1.0404 | .9985 |
| .9481 | .9302 | 1.0445 | .9974 |
| .9452 | .9240 | 1.0470 | .9966 |
| .9412 | .9146 | 1.0507 | .9954 |
| .9374 | .9051 | 1.0541 | .9941 |
| .9328 | .8921 | 1.0584 | .9925 |
| .9297 | .8822 | 1.0613 | .9913 |
| .9260 | .8688 | 1.0648 | .9897 |
| .9219 | .8520 | 1.0686 | .9880 |
| .9186 | .8350 | 1.0718 | .9864 |
| .9153 | .8148 | 1.0750 | .9848 |
| .9117 | .7848 | 1.0786 | .9830 |
| .9081 | .7371 | 1.0821 | .9812 |
| .9046 | .0405 | 1.0856 | .9796 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | −.2000 |
| 1.0086 | 1.0101 | −.1888 |
| 1.0171 | 1.0199 | −.1780 |
| 1.0255 | 1.0294 | −.1676 |
| 1.0336 | 1.0386 | −.1577 |
| 1.0416 | 1.0474 | −.1481 |
| 1.0494 | 1.0559 | −.1389 |
| 1.0607 | 1.0680 | −.1259 |
| 1.0680 | 1.0757 | −.1177 |
| 1.0752 | 1.0831 | −.1099 |
| 1.0855 | 1.0936 | −.0989 |
| 1.0921 | 1.1002 | −.0920 |
| 1.1016 | 1.1095 | −.0823 |
| 1.1077 | 1.1154 | −.0762 |
| 1.1164 | 1.1237 | −.0678 |
| 1.1245 | 1.1314 | −.0600 |
| 1.1346 | 1.1406 | −.0508 |
| 1.1415 | 1.1469 | −.0446 |
| 1.1499 | 1.1543 | −.0373 |
| 1.1591 | 1.1624 | −.0296 |
| 1.1669 | 1.1691 | −.0233 |
| 1.1746 | 1.1756 | −.0174 |
| 1.1831 | 1.1828 | −.0110 |
| 1.1916 | 1.1899 | −.0051 |
| 1.2000 | 1.1969 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0375 | .1348 | $-1.3783$ | $-2.3296$ | .2285 |
| .0225 | .1272 | $-1.3629$ | $-2.3622$ | .2166 |
| .0080 | .1200 | $-1.3472$ | $-2.3937$ | .2050 |
| $-.0062$ | .1130 | $-1.3312$ | $-2.4240$ | .1938 |
| $-.0201$ | .1063 | $-1.3148$ | $-2.4532$ | .1830 |
| $-.0336$ | .0999 | $-1.2981$ | $-2.4814$ | .1725 |
| $-.0468$ | .0937 | $-1.2812$ | $-2.5085$ | .1624 |
| $-.0661$ | .0850 | $-1.2553$ | $-2.5472$ | .1480 |
| $-.0786$ | .0795 | $-1.2377$ | $-2.5717$ | .1389 |
| $-.0908$ | .0742 | $-1.2200$ | $-2.5952$ | .1302 |
| $-.1087$ | .0668 | $-1.1932$ | $-2.6286$ | .1178 |
| $-.1204$ | .0621 | $-1.1751$ | $-2.6497$ | .1099 |
| $-.1374$ | .0556 | $-1.1480$ | $-2.6795$ | .0989 |
| $-.1485$ | .0515 | $-1.1298$ | $-2.6983$ | .0920 |
| $-.1647$ | .0458 | $-1.1027$ | $-2.7246$ | .0823 |
| $-.1805$ | .0406 | $-1.0759$ | $-2.7490$ | .0734 |
| $-.2007$ | .0344 | $-1.0406$ | $-2.7785$ | .0626 |
| $-.2154$ | .0303 | $-1.0149$ | $-2.7984$ | .0554 |
| $-.2342$ | .0254 | $-.9817$ | $-2.8222$ | .0468 |
| $-.2566$ | .0202 | $-.9425$ | $-2.8478$ | .0377 |
| $-.2776$ | .0160 | $-.9064$ | $-2.8691$ | .0301 |
| $-.3010$ | .0120 | $-.8678$ | $-2.8898$ | .0228 |
| $-.3326$ | .0078 | $-.8202$ | $-2.9125$ | .0149 |
| $-.3760$ | .0038 | $-.7683$ | $-2.9346$ | .0072 |
| $-.0001$ | .0000 | $-10.5013$ | $-2.9559$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1723 | $-1.3783$ | $-2.3221$ |
| .0329 | $-.0162$ | .1623 | $-1.3565$ | $-2.3347$ |
| .0660 | $-.0319$ | .1529 | $-1.3348$ | $-2.3461$ |
| .0992 | $-.0470$ | .1438 | $-1.3130$ | $-2.3563$ |
| .1326 | $-.0615$ | .1352 | $-1.2912$ | $-2.3655$ |
| .1661 | $-.0756$ | .1270 | $-1.2694$ | $-2.3737$ |
| .1998 | $-.0892$ | .1191 | $-1.2477$ | $-2.3810$ |
| .2505 | $-.1089$ | .1080 | $-1.2153$ | $-2.3904$ |
| .2845 | $-.1216$ | .1011 | $-1.1937$ | $-2.3958$ |
| .3185 | $-.1339$ | .0944 | $-1.1723$ | $-2.4005$ |
| .3697 | $-.1517$ | .0851 | $-1.1405$ | $-2.4065$ |
| .4039 | $-.1632$ | .0792 | $-1.1195$ | $-2.4098$ |
| .4553 | $-.1799$ | .0710 | $-1.0884$ | $-2.4140$ |
| .4895 | $-.1907$ | .0659 | $-1.0680$ | $-2.4162$ |
| .5408 | $-.2064$ | .0588 | $-1.0379$ | $-2.4189$ |
| .5920 | $-.2215$ | .0522 | $-1.0085$ | $-2.4209$ |
| .6600 | $-.2409$ | .0444 | $-.9707$ | $-2.4227$ |
| .7105 | $-.2549$ | .0392 | $-.9435$ | $-2.4235$ |
| .7773 | $-.2728$ | .0330 | $-.9090$ | $-2.4241$ |
| .8593 | $-.2939$ | .0264 | $-.8689$ | $-2.4242$ |
| .9393 | $-.3138$ | .0210 | $-.8326$ | $-2.4240$ |
| 1.0323 | $-.3359$ | .0159 | $-.7942$ | $-2.4233$ |
| 1.1646 | $-.3656$ | .0103 | $-.7478$ | $-2.4223$ |
| 1.3654 | $-.4064$ | .0050 | $-.6977$ | $-2.4208$ |
| 41.0992 | $-.0001$ | .0000 | $-9.5000$ | $-2.4190$ |

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**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-6.6612$ | $-.0299$ | 1.3539 |
| $-6.5880$ | $-.0296$ | 1.3630 |
| $-6.5118$ | $-.0291$ | 1.3734 |
| $-6.4328$ | $-.0283$ | 1.3850 |
| $-6.3515$ | $-.0274$ | 1.3975 |
| $-6.2679$ | $-.0264$ | 1.4108 |
| $-6.1824$ | $-.0253$ | 1.4247 |
| $-6.0508$ | $-.0235$ | 1.4466 |
| $-5.9612$ | $-.0223$ | 1.4616 |
| $-5.8703$ | $-.0211$ | 1.4769 |
| $-5.7319$ | $-.0193$ | 1.5001 |
| $-5.6384$ | $-.0180$ | 1.5156 |
| $-5.4967$ | $-.0163$ | 1.5387 |
| $-5.4015$ | $-.0152$ | 1.5539 |
| $-5.2578$ | $-.0135$ | 1.5762 |
| $-5.1136$ | $-.0120$ | 1.5976 |
| $-4.9211$ | $-.0102$ | 1.6247 |
| $-4.7771$ | $-.0090$ | 1.6437 |
| $-4.5865$ | $-.0075$ | 1.6671 |
| $-4.3516$ | $-.0060$ | 1.6930 |
| $-4.1220$ | $-.0048$ | 1.7151 |
| $-3.8557$ | $-.0036$ | 1.7368 |
| $-3.4793$ | $-.0023$ | 1.7607 |
| $-2.9227$ | $-.0011$ | 1.7838 |
| $-.0001$ | .0000 | 1.8044 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-6.1728$ | $-.5183$ | 1.2562 | $-.2344$ |
| $-6.0828$ | $-.4949$ | 1.2803 | $-.2279$ |
| $-5.9924$ | $-.4722$ | 1.3024 | $-.2213$ |
| $-5.9019$ | $-.4501$ | 1.3228 | $-.2145$ |
| $-5.8111$ | $-.4287$ | 1.3415 | $-.2075$ |
| $-5.7202$ | $-.4079$ | 1.3586 | $-.2005$ |
| $-5.6291$ | $-.3878$ | 1.3742 | $-.1934$ |
| $-5.4922$ | $-.3585$ | 1.3951 | $-.1827$ |
| $-5.4008$ | $-.3397$ | 1.4075 | $-.1755$ |
| $-5.3093$ | $-.3215$ | 1.4186 | $-.1683$ |
| $-5.1720$ | $-.2952$ | 1.4332 | $-.1576$ |
| $-5.0804$ | $-.2784$ | 1.4117 | $-.1505$ |
| $-4.9431$ | $-.2541$ | 1.4526 | $-.1400$ |
| $-4.8517$ | $-.2387$ | 1.4588 | $-.1332$ |
| $-4.7147$ | $-.2166$ | 1.4666 | $-.1231$ |
| $-4.5782$ | $-.1958$ | 1.4728 | $-.1133$ |
| $-4.3971$ | $-.1701$ | 1.4790 | $-.1008$ |
| $-4.2622$ | $-.1524$ | 1.4823 | $-.0919$ |
| $-4.0840$ | $-.1308$ | 1.4853 | $-.0808$ |
| $-3.8648$ | $-.1072$ | 1.4872 | $-.0680$ |
| $-3.6505$ | $-.0870$ | 1.4876 | $-.0567$ |
| $-3.4017$ | $-.0670$ | 1.4870 | $-.0451$ |
| $-3.0489$ | $-.0446$ | 1.4851 | $-.0313$ |
| $-2.5254$ | $-.0221$ | 1.4817 | $-.0165$ |
| $-.0001$ | $.0000$ | 1.4767 | $.0000$ |

# tableaux 41

## $\hat{n} = 0.95$ et $\gamma = 1.2$

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|---|---|---|---|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9946 | .9959 | 1.0050 | 1.0016 |
| .9895 | .9909 | 1.0097 | 1.0026 |
| .9848 | .9851 | 1.0142 | 1.0031 |
| .9803 | .9786 | 1.0184 | 1.0032 |
| .9762 | .9715 | 1.0223 | 1.0029 |
| .9724 | .9637 | 1.0258 | 1.0024 |
| .9690 | .9553 | 1.0291 | 1.0017 |
| .9660 | .9464 | 1.0320 | 1.0010 |
| .9634 | .9371 | 1.0346 | 1.0001 |
| .9611 | .9274 | 1.0368 | .9993 |
| .9591 | .9173 | 1.0387 | .9986 |
| .9575 | .9070 | 1.0403 | .9979 |
| .9551 | .8860 | 1.0427 | .9968 |
| .9533 | .8596 | 1.0444 | .9960 |
| .9513 | .0320 | 1.0464 | .9950 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | −.1000 |
| 1.0104 | 1.0125 | −.0882 |
| 1.0204 | 1.0239 | −.0772 |
| 1.0299 | 1.0344 | −.0670 |
| 1.0388 | 1.0439 | −.0575 |
| 1.0472 | 1.0524 | −.0489 |
| 1.0549 | 1.0601 | −.0411 |
| 1.0620 | 1.0668 | −.0341 |
| 1.0683 | 1.0726 | −.0280 |
| 1.0739 | 1.0777 | −.0227 |
| 1.0788 | 1.0819 | −.0182 |
| 1.0830 | 1.0855 | −.0144 |
| 1.0865 | 1.0885 | −.0113 |
| 1.0917 | 1.0928 | −.0067 |
| 1.0956 | 1.0959 | −.0034 |
| 1.1000 | 1.0995 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| .0189 | .0491 | $-1.1862$ | $-2.1748$ | .1082 |
| .0058 | .0423 | $-1.1385$ | $-2.2073$ | .0949 |
| $-.0074$ | .0361 | $-1.0892$ | $-2.2374$ | .0826 |
| $-.0204$ | .0305 | $-1.0385$ | $-2.2649$ | .0712 |
| $-.0335$ | .0254 | $-.9867$ | $-2.2901$ | .0608 |
| $-.0466$ | .0209 | $-.9341$ | $-2.3129$ | .0513 |
| $-.0598$ | .0170 | $-.8812$ | $-2.3333$ | .0429 |
| $-.0729$ | .0137 | $-.8285$ | $-2.3515$ | .0355 |
| $-.0861$ | .0108 | $-.7764$ | $-2.3675$ | .0290 |
| $-.0991$ | .0085 | $-.7257$ | $-2.3814$ | .0234 |
| $-.1121$ | .0065 | $-.6769$ | $-2.3933$ | .0187 |
| $-.1249$ | .0050 | $-.6308$ | $-2.4033$ | .0148 |
| $-.1374$ | .0038 | $-.5878$ | $-2.4115$ | .0116 |
| $-.1615$ | .0021 | $-.5125$ | $-2.4237$ | .0070 |
| $-.1894$ | .0010 | $-.4398$ | $-2.4328$ | .0036 |
| .0001 | .0000 | $-6.3735$ | $-2.4427$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0755 | $-1.1862$ | $-2.1648$ |
| .0660 | $-.0162$ | .0655 | $-1.1323$ | $-2.1775$ |
| .1332 | $-.0316$ | .0564 | $-1.0778$ | $-2.1875$ |
| .2014 | $-.0463$ | .0482 | $-1.0227$ | $-2.1953$ |
| .2705 | $-.0604$ | .0408 | $-.9673$ | $-2.2012$ |
| .3403 | $-.0741$ | .0341 | $-.9119$ | $-2.2055$ |
| .4103 | $-.0875$ | .0283 | $-.8569$ | $-2.2086$ |
| .4804 | $-.1006$ | .0231 | $-.8028$ | $-2.2106$ |
| .5500 | $-.1135$ | .0187 | $-.7500$ | $-2.2118$ |
| .6186 | $-.1261$ | .0149 | $-.6991$ | $-2.2124$ |
| .6858 | $-.1386$ | .0118 | $-.6506$ | $-2.2126$ |
| .7510 | $-.1509$ | .0092 | $-.6050$ | $-2.2126$ |
| .8138 | $-.1629$ | .0072 | $-.5628$ | $-2.2125$ |
| .9306 | $-.1860$ | .0042 | $-.4895$ | $-2.2119$ |
| 1.0587 | $-.2127$ | .0021 | $-.4192$ | $-2.2114$ |
| 59.2192 | .0001 | .0000 | $-6.0632$ | $-2.2106$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-11.4429$ | $-.0047$ | $1.2959$ |
| $-11.3310$ | $-.0058$ | $1.2906$ |
| $-11.1981$ | $-.0061$ | $1.2922$ |
| $-11.0464$ | $-.0059$ | $1.2994$ |
| $-10.8777$ | $-.0054$ | $1.3109$ |
| $-10.6936$ | $-.0048$ | $1.3255$ |
| $-10.4959$ | $-.0041$ | $1.3422$ |
| $-10.2860$ | $-.0034$ | $1.3599$ |
| $-10.0659$ | $-.0028$ | $1.3778$ |
| $-9.8371$ | $-.0022$ | $1.3950$ |
| $-9.6016$ | $-.0017$ | $1.4109$ |
| $-9.3614$ | $-.0013$ | $1.4252$ |
| $-9.1184$ | $-.0010$ | $1.4376$ |
| $-8.6317$ | $-.0006$ | $1.4565$ |
| $-8.0388$ | $-.0003$ | $1.4711$ |
| $-.0006$ | $.0000$ | $1.4866$ |

| $\rho_{22}^{*}$ | $u_{22}^{*}$ | $p_{22}^{*}$ | $\psi_{22}$ |
|---|---|---|---|
| $-11.0803$ | $-.5097$ | $1.1043$ | $-.1083$ |
| $-10.9103$ | $-.4547$ | $1.1575$ | $-.1011$ |
| $-10.7343$ | $-.4029$ | $1.2018$ | $-.0936$ |
| $-10.5520$ | $-.3543$ | $1.2383$ | $-.0860$ |
| $-10.3632$ | $-.3089$ | $1.2678$ | $-.0782$ |
| $-10.1677$ | $-.2666$ | $1.2912$ | $-.0705$ |
| $-9.9655$ | $-.2277$ | $1.3092$ | $-.0629$ |
| $-9.7566$ | $-.1922$ | $1.3227$ | $-.0555$ |
| $-9.5412$ | $-.1604$ | $1.3325$ | $-.0484$ |
| $-9.3201$ | $-.1321$ | $1.3392$ | $-.0417$ |
| $-9.0938$ | $-.1075$ | $1.3436$ | $-.0355$ |
| $-8.8637$ | $-.0865$ | $1.3462$ | $-.0299$ |
| $-8.6309$ | $-.0688$ | $1.3476$ | $-.0249$ |
| $-8.1636$ | $-.0424$ | $1.3483$ | $-.0167$ |
| $-7.5916$ | $-.0224$ | $1.3476$ | $-.0097$ |
| $-.0006$ | $.0000$ | $1.3453$ | $.0000$ |

# tableaux 42

## $\hat{n} = 0.95$ et $\gamma = 1.4$

Ecoulement de base

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|---|---|---|---|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9947 | 1.0000 | 1.0054 | 1.0035 |
| .9894 | .9997 | 1.0106 | 1.0066 |
| .9843 | .9989 | 1.0157 | 1.0094 |
| .9794 | .9978 | 1.0207 | 1.0118 |
| .9745 | .9963 | 1.0255 | 1.0138 |
| .9698 | .9945 | 1.0303 | 1.0155 |
| .9653 | .9923 | 1.0349 | 1.0170 |
| .9608 | .9898 | 1.0393 | 1.0182 |
| .9565 | .9869 | 1.0437 | 1.0191 |
| .9524 | .9838 | 1.0479 | 1.0198 |
| .9485 | .9802 | 1.0519 | 1.0204 |
| .9447 | .9764 | 1.0558 | 1.0207 |
| .9411 | .9722 | 1.0595 | 1.0209 |
| .9376 | .9677 | 1.0631 | 1.0209 |
| .9344 | .9628 | 1.0665 | 1.0208 |
| .9314 | .9576 | 1.0696 | 1.0206 |
| .9273 | .9491 | 1.0740 | 1.0202 |
| .9237 | .9399 | 1.0778 | 1.0196 |
| .9206 | .9300 | 1.0811 | 1.0191 |
| .9174 | .9157 | 1.0847 | 1.0184 |
| .9137 | .8887 | 1.0887 | 1.0175 |
| .9103 | .0415 | 1.0924 | 1.0165 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|---------|
| 1.0000 | 1.0000 | $-.2000$ |
| 1.0108 | 1.0143 | $-.1872$ |
| 1.0214 | 1.0282 | $-.1748$ |
| 1.0319 | 1.0417 | $-.1627$ |
| 1.0422 | 1.0548 | $-.1510$ |
| 1.0523 | 1.0675 | $-.1397$ |
| 1.0623 | 1.0797 | $-.1288$ |
| 1.0721 | 1.0915 | $-.1182$ |
| 1.0817 | 1.1029 | $-.1081$ |
| 1.0911 | 1.1138 | $-.0984$ |
| 1.1002 | 1.1243 | $-.0890$ |
| 1.1091 | 1.1343 | $-.0802$ |
| 1.1176 | 1.1438 | $-.0718$ |
| 1.1259 | 1.1527 | $-.0638$ |
| 1.1338 | 1.1612 | $-.0563$ |
| 1.1413 | 1.1691 | $-.0493$ |
| 1.1484 | 1.1765 | $-.0429$ |
| 1.1582 | 1.1864 | $-.0341$ |
| 1.1669 | 1.1950 | $-.0266$ |
| 1.1743 | 1.2023 | $-.0203$ |
| 1.1823 | 1.2101 | $-.0136$ |
| 1.1916 | 1.2188 | $-.0062$ |
| 1.2000 | 1.2267 | $.0000$ |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| $-.0022$ | .1054 | $-1.3142$ | $-2.2480$ | .2255 |
| $-.0078$ | .0984 | $-1.2975$ | $-2.2823$ | .2108 |
| $-.0135$ | .0916 | $-1.2800$ | $-2.3157$ | .1965 |
| $-.0193$ | .0850 | $-1.2616$ | $-2.3483$ | .1826 |
| $-.0253$ | .0786 | $-1.2423$ | $-2.3799$ | .1691 |
| $-.0313$ | .0724 | $-1.2221$ | $-2.4106$ | .1561 |
| $-.0375$ | .0665 | $-1.2010$ | $-2.4403$ | .1436 |
| $-.0437$ | .0607 | $-1.1790$ | $-2.4690$ | .1316 |
| $-.0502$ | .0552 | $-1.1561$ | $-2.4968$ | .1200 |
| $-.0568$ | .0499 | $-1.1323$ | $-2.5235$ | .1090 |
| $-.0635$ | .0449 | $-1.1076$ | $-2.5492$ | .0985 |
| $-.0704$ | .0401 | $-1.0821$ | $-2.5738$ | .0885 |
| $-.0775$ | .0356 | $-1.0558$ | $-2.5973$ | .0790 |
| $-.0848$ | .0314 | $-1.0288$ | $-2.6195$ | .0701 |
| $-.0923$ | .0275 | $-1.0011$ | $-2.6406$ | .0618 |
| $-.0999$ | .0238 | $-.9728$ | $-2.6604$ | .0541 |
| $-.1078$ | .0205 | $-.9442$ | $-2.6789$ | .0469 |
| $-.1201$ | .0160 | $-.9009$ | $-2.7041$ | .0373 |
| $-.1327$ | .0123 | $-.8578$ | $-2.7260$ | .0291 |
| $-.1458$ | .0092 | $-.8159$ | $-2.7447$ | .0222 |
| $-.1636$ | .0061 | $-.7636$ | $-2.7645$ | .0150 |
| $-.1949$ | .0027 | $-.6877$ | $-2.7871$ | .0070 |
| .0000 | .0000 | $-10.4883$ | $-2.8073$ | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1568 | −1.3142 | −2.2126 |
| .0359 | −.0094 | .1461 | −1.2906 | −2.2279 |
| .0726 | −.0184 | .1357 | −1.2665 | −2.2416 |
| .1103 | −.0272 | .1258 | −1.2418 | −2.2540 |
| .1490 | −.0357 | .1163 | −1.2167 | −2.2650 |
| .1887 | −.0440 | .1072 | −1.1910 | −2.2749 |
| .2294 | −.0521 | .0984 | −1.1648 | −2.2836 |
| .2712 | −.0600 | .0901 | −1.1380 | −2.2913 |
| .3142 | −.0679 | .0821 | −1.1108 | −2.2980 |
| .3583 | −.0756 | .0744 | −1.0831 | −2.3038 |
| .4037 | −.0834 | .0672 | −1.0549 | −2.3088 |
| .4504 | −.0910 | .0603 | −1.0264 | −2.3130 |
| .4985 | −.0987 | .0538 | −.9974 | −2.3165 |
| .5479 | −.1064 | .0477 | −.9681 | −2.3194 |
| .5988 | −.1142 | .0419 | −.9387 | −2.3217 |
| .6511 | −.1221 | .0366 | −.9090 | −2.3236 |
| .7048 | −.1300 | .0317 | −.8794 | −2.3250 |
| .7880 | −.1422 | .0251 | −.8354 | −2.3264 |
| .8740 | −.1546 | .0195 | −.7924 | −2.3272 |
| .9624 | −.1673 | .0148 | −.7512 | −2.3275 |
| 1.0827 | −.1846 | .0099 | −.7005 | −2.3275 |
| 1.2936 | −.2150 | .0046 | −.6283 | −2.3272 |
| 124.9148 | .0000 | .0000 | −9.5478 | −2.3264 |

**Ecoulement d'ordre 2
effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|:---:|:---:|:---:|
| −5.5170 | .0062 | 1.3721 |
| −5.5143 | .0031 | 1.3640 |
| −5.5057 | .0007 | 1.3586 |
| −5.4916 | −.0012 | 1.3556 |
| −5.4725 | −.0026 | 1.3546 |
| −5.4484 | −.0036 | 1.3556 |
| −5.4196 | −.0043 | 1.3583 |
| −5.3862 | −.0047 | 1.3626 |
| −5.3485 | −.0049 | 1.3682 |
| −5.3064 | −.0050 | 1.3750 |
| −5.2601 | −.0049 | 1.3829 |
| −5.2097 | −.0047 | 1.3916 |
| −5.1551 | −.0044 | 1.4010 |
| −5.0964 | −.0040 | 1.4110 |
| −5.0337 | −.0036 | 1.4214 |
| −4.9669 | −.0033 | 1.4319 |
| −4.8962 | −.0029 | 1.4425 |
| −4.7828 | −.0023 | 1.4580 |
| −4.6611 | −.0018 | 1.4726 |
| −4.5318 | −.0014 | 1.4857 |
| −4.3495 | −.0009 | 1.5004 |
| −4.0147 | −.0004 | 1.5178 |
| −.0008 | .0000 | 1.5337 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-5.5402$ | $-.5255$ | $1.0069$ | $-.2108$ |
| $-5.4983$ | $-.4949$ | $1.0382$ | $-.1997$ |
| $-5.4551$ | $-.4654$ | $1.0668$ | $-.1887$ |
| $-5.4107$ | $-.4367$ | $1.0928$ | $-.1779$ |
| $-5.3648$ | $-.4088$ | $1.1166$ | $-.1672$ |
| $-5.3175$ | $-.3817$ | $1.1381$ | $-.1568$ |
| $-5.2685$ | $-.3554$ | $1.1575$ | $-.1466$ |
| $-5.2179$ | $-.3297$ | $1.1751$ | $-.1366$ |
| $-5.1655$ | $-.3048$ | $1.1907$ | $-.1268$ |
| $-5.1112$ | $-.2805$ | $1.2047$ | $-.1173$ |
| $-5.0549$ | $-.2570$ | $1.2169$ | $-.1081$ |
| $-4.9964$ | $-.2342$ | $1.2277$ | $-.0992$ |
| $-4.9356$ | $-.2122$ | $1.2370$ | $-.0905$ |
| $-4.8724$ | $-.1911$ | $1.2449$ | $-.0822$ |
| $-4.8066$ | $-.1709$ | $1.2515$ | $-.0742$ |
| $-4.7381$ | $-.1516$ | $1.2570$ | $-.0665$ |
| $-4.6668$ | $-.1334$ | $1.2614$ | $-.0593$ |
| $-4.5542$ | $-.1083$ | $1.2663$ | $-.0491$ |
| $-4.4348$ | $-.0860$ | $1.2695$ | $-.0399$ |
| $-4.3088$ | $-.0668$ | $1.2713$ | $-.0319$ |
| $-4.1319$ | $-.0460$ | $1.2724$ | $-.0228$ |
| $-3.8067$ | $-.0220$ | $1.2723$ | $-.0118$ |
| $-.0008$ | $.0000$ | $1.2710$ | $.0000$ |

# tableaux 43

## n̂ = 1.OO et γ = 1.2

**Ecoulement de base**

| $\xi$ | $\rho_0$ | $u_0^*$ | $p_0^*$ |
|--------|----------|----------|----------|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9981 | 1.0017 | 1.0021 | 1.0021 |
| .9961 | 1.0034 | 1.0042 | 1.0041 |
| .9942 | 1.0049 | 1.0063 | 1.0059 |
| .9922 | 1.0064 | 1.0084 | 1.0077 |
| .9903 | 1.0079 | 1.0105 | 1.0094 |
| .9884 | 1.0092 | 1.0126 | 1.0110 |
| .9865 | 1.0104 | 1.0146 | 1.0125 |
| .9845 | 1.0116 | 1.0167 | 1.0140 |
| .9826 | 1.0127 | 1.0187 | 1.0153 |
| .9807 | 1.0138 | 1.0208 | 1.0165 |
| .9788 | 1.0147 | 1.0228 | 1.0177 |
| .9770 | 1.0156 | 1.0248 | 1.0187 |
| .9751 | 1.0164 | 1.0268 | 1.0197 |
| .9732 | 1.0171 | 1.0288 | 1.0206 |
| .9714 | 1.0178 | 1.0308 | 1.0214 |
| .9695 | 1.0184 | 1.0328 | 1.0221 |
| .9677 | 1.0189 | 1.0348 | 1.0228 |
| .9658 | 1.0194 | 1.0368 | 1.0233 |
| .9640 | 1.0198 | 1.0387 | 1.0238 |
| .9622 | 1.0201 | 1.0407 | 1.0242 |
| .9604 | 1.0204 | 1.0427 | 1.0245 |
| .9586 | 1.0206 | 1.0446 | 1.0248 |
| .9568 | 1.0207 | 1.0466 | 1.0249 |
| .9550 | 1.0208 | 1.0485 | 1.0250 |
| .9541 | 1.0208 | 1.0495 | 1.0250 |

| $u_0$ | $p_0$ | $\psi_0$ |
|---|---|---|
| 1.0000 | 1.0000 | −.1000 |
| 1.0041 | 1.0060 | −.0957 |
| 1.0082 | 1.0119 | −.0914 |
| 1.0122 | 1.0178 | −.0872 |
| 1.0163 | 1.0236 | −.0829 |
| 1.0204 | 1.0293 | −.0787 |
| 1.0245 | 1.0350 | −.0745 |
| 1.0286 | 1.0405 | −.0702 |
| 1.0326 | 1.0460 | −.0661 |
| 1.0367 | 1.0515 | −.0619 |
| 1.0408 | 1.0569 | −.0577 |
| 1.0449 | 1.0621 | −.0536 |
| 1.0490 | 1.0673 | −.0495 |
| 1.0530 | 1.0725 | −.0454 |
| 1.0571 | 1.0776 | −.0413 |
| 1.0612 | 1.0825 | −.0372 |
| 1.0653 | 1.0875 | −.0332 |
| 1.0694 | 1.0923 | −.0292 |
| 1.0735 | 1.0971 | −.0252 |
| 1.0775 | 1.1017 | −.0213 |
| 1.0816 | 1.1063 | −.0174 |
| 1.0857 | 1.1108 | −.0135 |
| 1.0898 | 1.1152 | −.0096 |
| 1.0939 | 1.1196 | −.0057 |
| 1.0979 | 1.1239 | −.0019 |
| 1.1000 | 1.1259 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| −.0268 | .0383 | −1.1295 | −2.0912 | .0059 |
| −.0278 | .0363 | −1.1135 | −2.1022 | .0054 |
| −.0287 | .0344 | −1.0969 | −2.1132 | .0050 |
| −.0296 | .0324 | −1.0798 | −2.1240 | .0045 |
| −.0304 | .0305 | −1.0620 | −2.1347 | .0041 |
| −.0312 | .0286 | −1.0435 | −2.1454 | .0037 |
| −.0320 | .0267 | −1.0243 | −2.1559 | .0034 |
| −.0327 | .0249 | −1.0044 | −2.1662 | .0030 |
| −.0334 | .0231 | −.9837 | −2.1765 | .0027 |
| −.0340 | .0213 | −.9620 | −2.1867 | .0024 |
| −.0346 | .0196 | −.9395 | −2.1968 | .0021 |
| −.0351 | .0179 | −.9160 | −2.2067 | .0018 |
| −.0356 | .0163 | −.8913 | −2.2165 | .0015 |
| −.0361 | .0147 | −.8654 | −2.2262 | .0013 |
| −.0365 | .0131 | −.8378 | −2.2359 | .0011 |
| −.0369 | .0116 | −.8089 | −2.2454 | .0009 |
| −.0372 | .0102 | −.7781 | −2.2547 | .0007 |
| −.0374 | .0088 | −.7451 | −2.2640 | .0005 |
| −.0376 | .0074 | −.7093 | −2.2733 | .0004 |
| −.0378 | .0061 | −.6705 | −2.2824 | .0003 |
| −.0379 | .0049 | −.6276 | −2.2914 | .0002 |
| −.0379 | .0038 | −.5792 | −2.3003 | .0001 |
| −.0379 | .0028 | −.5228 | −2.3091 | .0001 |
| −.0378 | .0019 | −.4524 | −2.3179 | .0000 |
| −.0376 | .0011 | −.3498 | −2.3266 | .0000 |
| −.0374 | .0009 | −.2237 | −2.3310 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .0705 | $-1.1295$ | $-2.0590$ |
| .0223 | $-.0032$ | .0670 | $-1.1113$ | $-2.0646$ |
| .0453 | $-.0063$ | .0635 | $-1.0927$ | $-2.0699$ |
| .0689 | $-.0093$ | .0601 | $-1.0735$ | $-2.0749$ |
| .0932 | $-.0120$ | .0567 | $-1.0538$ | $-2.0796$ |
| .1184 | $-.0147$ | .0534 | $-1.0333$ | $-2.0841$ |
| .1443 | $-.0172$ | .0501 | $-1.0124$ | $-2.0882$ |
| .1711 | $-.0195$ | .0469 | $-.9908$ | $-2.0921$ |
| .2279 | $-.0237$ | .0406 | $-.9453$ | $-2.0991$ |
| .2579 | $-.0256$ | .0376 | $-.9214$ | $-2.1021$ |
| .2893 | $-.0274$ | .0346 | $-.8966$ | $-2.1050$ |
| .3220 | $-.0290$ | .0317 | $-.8708$ | $-2.1076$ |
| .3565 | $-.0305$ | .0288 | $-.8438$ | $-2.1099$ |
| .3931 | $-.0319$ | .0259 | $-.8154$ | $-2.1121$ |
| .4316 | $-.0331$ | .0232 | $-.7857$ | $-2.1140$ |
| .4728 | $-.0341$ | .0205 | $-.7543$ | $-2.1157$ |
| .5172 | $-.0351$ | .0179 | $-.7210$ | $-2.1171$ |
| .5658 | $-.0359$ | .0153 | $-.6850$ | $-2.1184$ |
| .6192 | $-.0365$ | .0128 | $-.6463$ | $-2.1194$ |
| .6792 | $-.0370$ | .0104 | $-.6039$ | $-2.1203$ |
| .7489 | $-.0374$ | .0081 | $-.5563$ | $-2.1210$ |
| .8337 | $-.0376$ | .0058 | $-.5012$ | $-2.1215$ |
| .9478 | $-.0377$ | .0037 | $-.4328$ | $-2.1218$ |
| 1.1457 | $-.0376$ | .0017 | $-.3340$ | $-2.1219$ |
| 1.6847 | $-.0374$ | .0008 | $-.2134$ | $-2.1220$ |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| $-9.5665$ | $-.0029$ | $1.3906$ |
| $-9.5607$ | $-.0018$ | $1.3742$ |
| $-9.5554$ | $-.0005$ | $1.3588$ |
| $-9.5505$ | $.0009$ | $1.3445$ |
| $-9.5461$ | $.0024$ | $1.3313$ |
| $-9.5420$ | $.0039$ | $1.3189$ |
| $-9.5384$ | $.0056$ | $1.3075$ |
| $-9.5352$ | $.0073$ | $1.2971$ |
| $-9.5323$ | $.0091$ | $1.2875$ |
| $-9.5297$ | $.0110$ | $1.2788$ |
| $-9.5275$ | $.0129$ | $1.2710$ |
| $-9.5255$ | $.0149$ | $1.2640$ |
| $-9.5238$ | $.0169$ | $1.2578$ |
| $-9.5224$ | $.0190$ | $1.2525$ |
| $-9.5213$ | $.0212$ | $1.2479$ |
| $-9.5203$ | $.0233$ | $1.2441$ |
| $-9.5196$ | $.0255$ | $1.2411$ |
| $-9.5191$ | $.0278$ | $1.2388$ |
| $-9.5188$ | $.0301$ | $1.2373$ |
| $-9.5187$ | $.0324$ | $1.2365$ |
| $-9.5187$ | $.0347$ | $1.2365$ |
| $-9.5189$ | $.0371$ | $1.2372$ |
| $-9.5193$ | $.0395$ | $1.2387$ |
| $-9.5197$ | $.0419$ | $1.2409$ |
| $-9.5203$ | $.0443$ | $1.2439$ |
| $-9.5207$ | $.0455$ | $1.2456$ |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| $-10.0000$ | $-.5231$ | .8704 | $-.0477$ |
| $-9.9572$ | $-.4981$ | .8928 | $-.0438$ |
| $-9.9169$ | $-.4734$ | .9141 | $-.0401$ |
| $-9.8789$ | $-.4490$ | .9344 | $-.0365$ |
| $-9.8432$ | $-.4248$ | .9536 | $-.0331$ |
| $-9.8095$ | $-.4007$ | .9720 | $-.0299$ |
| $-9.7781$ | $-.3770$ | .9892 | $-.0268$ |
| $-9.7488$ | $-.3534$ | 1.0054 | $-.0239$ |
| $-9.7214$ | $-.3300$ | 1.0206 | $-.0212$ |
| $-9.6959$ | $-.3067$ | 1.0349 | $-.0187$ |
| $-9.6724$ | $-.2836$ | 1.0481 | $-.0163$ |
| $-9.6507$ | $-.2607$ | 1.0604 | $-.0141$ |
| $-9.6309$ | $-.2378$ | 1.0717 | $-.0120$ |
| $-9.6128$ | $-.2151$ | 1.0821 | $-.0101$ |
| $-9.5963$ | $-.1923$ | 1.0916 | $-.0084$ |
| $-9.5816$ | $-.1698$ | 1.1000 | $-.0069$ |
| $-9.5686$ | $-.1473$ | 1.1076 | $-.0055$ |
| $-9.5572$ | $-.1248$ | 1.1142 | $-.0043$ |
| $-9.5473$ | $-.1023$ | 1.1198 | $-.0032$ |
| $-9.5390$ | $-.0799$ | 1.1246 | $-.0023$ |
| $-9.5323$ | $-.0575$ | 1.1284 | $-.0015$ |
| $-9.5271$ | $-.0351$ | 1.1312 | $-.0009$ |
| $-9.5235$ | $-.0128$ | 1.1331 | $-.0005$ |
| $-9.5212$ | .0097 | 1.1342 | $-.0002$ |
| $-9.5205$ | .0321 | 1.1342 | .0000 |
| $-9.5207$ | .0433 | 1.1339 | .0000 |

# tableaux 44

## n̂ = 1.00 et γ = 1.4

**Ecoulement de base**

| ξ | ρ₀ | u₀* | p₀* |
|---|---|---|---|
| 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| .9962 | 1.0031 | 1.0044 | 1.0043 |
| .9925 | 1.0059 | 1.0087 | 1.0083 |
| .9888 | 1.0087 | 1.0130 | 1.0122 |
| .9851 | 1.0113 | 1.0172 | 1.0158 |
| .9814 | 1.0137 | 1.0214 | 1.0192 |
| .9777 | 1.0160 | 1.0256 | 1.0224 |
| .9741 | 1.0181 | 1.0297 | 1.0254 |
| .9705 | 1.0201 | 1.0338 | 1.0283 |
| .9669 | 1.0220 | 1.0379 | 1.0309 |
| .9633 | 1.0237 | 1.0419 | 1.0333 |
| .9598 | 1.0253 | 1.0459 | 1.0356 |
| .9563 | 1.0268 | 1.0499 | 1.0377 |
| .9528 | 1.0281 | 1.0539 | 1.0396 |
| .9493 | 1.0293 | 1.0578 | 1.0413 |
| .9459 | 1.0304 | 1.0617 | 1.0429 |
| .9425 | 1.0314 | 1.0656 | 1.0442 |
| .9392 | 1.0323 | 1.0695 | 1.0455 |
| .9358 | 1.0330 | 1.0733 | 1.0465 |
| .9325 | 1.0337 | 1.0772 | 1.0474 |
| .9293 | 1.0342 | 1.0810 | 1.0482 |
| .9260 | 1.0346 | 1.0848 | 1.0488 |
| .9228 | 1.0349 | 1.0885 | 1.0492 |
| .9196 | 1.0351 | 1.0923 | 1.0495 |
| .9165 | 1.0352 | 1.0960 | 1.0497 |
| .9149 | 1.0352 | 1.0979 | 1.0497 |

| $u_0$ | $p_0$ | $\psi_0$ |
|--------|--------|--------|
| 1.0000 | 1.0000 | −.2000 |
| 1.0082 | 1.0119 | −.1910 |
| 1.0163 | 1.0236 | −.1820 |
| 1.0245 | 1.0353 | −.1731 |
| 1.0326 | 1.0468 | −.1643 |
| 1.0408 | 1.0583 | −.1554 |
| 1.0490 | 1.0696 | −.1467 |
| 1.0571 | 1.0807 | −.1380 |
| 1.0653 | 1.0918 | −.1294 |
| 1.0735 | 1.1028 | −.1209 |
| 1.0816 | 1.1135 | −.1125 |
| 1.0898 | 1.1242 | −.1041 |
| 1.0979 | 1.1347 | −.0958 |
| 1.1061 | 1.1451 | −.0877 |
| 1.1143 | 1.1554 | −.0795 |
| 1.1224 | 1.1655 | −.0715 |
| 1.1306 | 1.1755 | −.0636 |
| 1.1387 | 1.1853 | −.0558 |
| 1.1469 | 1.1950 | −.0480 |
| 1.1551 | 1.2045 | −.0404 |
| 1.1632 | 1.2138 | −.0328 |
| 1.1714 | 1.2230 | −.0254 |
| 1.1795 | 1.2320 | −.0180 |
| 1.1877 | 1.2410 | −.0107 |
| 1.1959 | 1.2496 | −.0036 |
| 1.2000 | 1.2540 | .0000 |

**Ecoulement d'ordre 1 du courant**

| $\rho_1$ | $u_1$ | $v_1$ | $p_1$ | $\psi_1$ |
|---|---|---|---|---|
| −.0444 | .0845 | −1.2533 | −2.1688 | .0213 |
| −.0459 | .0806 | −1.2423 | −2.1913 | .0196 |
| −.0474 | .0767 | −1.2307 | −2.2137 | .0180 |
| −.0486 | .0729 | −1.2184 | −2.2360 | .0164 |
| −.0498 | .0690 | −1.2054 | −2.2582 | .0149 |
| −.0508 | .0651 | −1.1916 | −2.2803 | .0134 |
| −.0518 | .0613 | −1.1771 | −2.3022 | .0121 |
| −.0526 | .0575 | −1.1617 | −2.3238 | .0108 |
| −.0533 | .0537 | −1.1455 | −2.3453 | .0096 |
| −.0539 | .0499 | −1.1283 | −2.3668 | .0084 |
| −.0545 | .0462 | −1.1101 | −2.3879 | .0073 |
| −.0550 | .0426 | −1.0908 | −2.4088 | .0064 |
| −.0553 | .0390 | −1.0702 | −2.4296 | .0054 |
| −.0556 | .0355 | −1.0483 | −2.4501 | .0046 |
| −.0559 | .0320 | −1.0248 | −2.4705 | .0038 |
| −.0560 | .0286 | −.9997 | −2.4906 | .0031 |
| −.0561 | .0253 | −.9727 | −2.5105 | .0025 |
| −.0561 | .0221 | −.9434 | −2.5302 | .0019 |
| −.0560 | .0189 | −.9112 | −2.5497 | .0014 |
| −.0559 | .0159 | −.8759 | −2.5690 | .0010 |
| −.0556 | .0130 | −.8364 | −2.5881 | .0007 |
| −.0553 | .0103 | −.7912 | −2.6069 | .0004 |
| −.0549 | .0077 | −.7380 | −2.6256 | .0002 |
| −.0544 | .0053 | −.6705 | −2.6442 | .0001 |
| −.0538 | .0032 | −.5708 | −2.6626 | .0000 |
| −.0534 | .0023 | −.4364 | −2.6717 | .0000 |

| $\phi_1$ | $\rho_1^*$ | $u_1^*$ | $v_1^*$ | $p_1^*$ |
|---|---|---|---|---|
| .0000 | .0000 | .1467 | −1.2533 | −2.1066 |
| .0240 | −.0056 | .1394 | −1.2376 | −2.1183 |
| .0487 | −.0107 | .1322 | −1.2214 | −2.1293 |
| .0743 | −.0156 | .1251 | −1.2047 | −2.1397 |
| .1008 | −.0200 | .1182 | −1.1874 | −2.1494 |
| .1285 | −.0241 | .1113 | −1.1694 | −2.1586 |
| .1570 | −.0279 | .1046 | −1.1509 | −2.1672 |
| .1866 | −.0314 | .0980 | −1.1316 | −2.1752 |
| .2175 | −.0347 | .0916 | −1.1117 | −2.1826 |
| .2499 | −.0376 | .0852 | −1.0909 | −2.1895 |
| .2836 | −.0403 | .0789 | −1.0693 | −2.1959 |
| .3190 | −.0427 | .0728 | −1.0469 | −2.2017 |
| .3562 | −.0449 | .0667 | −1.0234 | −2.2070 |
| .3956 | −.0469 | .0608 | −.9989 | −2.2118 |
| .4377 | −.0486 | .0550 | −.9729 | −2.2162 |
| .4824 | −.0501 | .0493 | −.9457 | −2.2201 |
| .5306 | −.0514 | .0437 | −.9168 | −2.2235 |
| .5830 | −.0524 | .0382 | −.8860 | −2.2265 |
| .6410 | −.0533 | .0329 | −.8527 | −2.2291 |
| .7055 | −.0539 | .0277 | −.8168 | −2.2313 |
| .7792 | −.0543 | .0226 | −.7772 | −2.2331 |
| .8664 | −.0545 | .0177 | −.7327 | −2.2344 |
| .9753 | −.0545 | .0129 | −.6810 | −2.2355 |
| 1.1274 | −.0543 | .0084 | −.6167 | −2.2361 |
| 1.4103 | −.0538 | .0041 | −.5231 | −2.2365 |
| | −.0534 | .0021 | −.3992 | −2.2365 |

**Ecoulement d'ordre 2**
**effet de la contre-pression**

| $\rho_{22}$ | $u_{22}$ | $p_{22}$ |
|---|---|---|
| −4.6192 | −.0100 | 1.3041 |
| −4.6092 | −.0075 | 1.2903 |
| −4.6001 | −.0049 | 1.2779 |
| −4.5919 | −.0020 | 1.2669 |
| −4.5845 | .0010 | 1.2570 |
| −4.5778 | .0041 | 1.2483 |
| −4.5719 | .0074 | 1.2406 |
| −4.5667 | .0109 | 1.2341 |
| −4.5620 | .0144 | 1.2284 |
| −4.5579 | .0181 | 1.2237 |
| −4.5543 | .0218 | 1.2199 |
| −4.5512 | .0256 | 1.2169 |
| −4.5486 | .0296 | 1.2147 |
| −4.5464 | .0336 | 1.2133 |
| −4.5446 | .0377 | 1.2126 |
| −4.5432 | .0418 | 1.2127 |
| −4.5421 | .0460 | 1.2135 |
| −4.5413 | .0503 | 1.2150 |
| −4.5408 | .0547 | 1.2172 |
| −4.5406 | .0591 | 1.2200 |
| −4.5406 | .0635 | 1.2235 |
| −4.5409 | .0680 | 1.2276 |
| −4.5414 | .0725 | 1.2324 |
| −4.5421 | .0771 | 1.2379 |
| −4.5430 | .0818 | 1.2439 |
| −4.5435 | .0841 | 1.2472 |

| $\rho_{22}^*$ | $u_{22}^*$ | $p_{22}^*$ | $\psi_{22}$ |
|---|---|---|---|
| −5.0000 | −.5431 | .7710 | −.0914 |
| −4.9554 | −.5138 | .7953 | −.0837 |
| −4.9140 | −.4852 | .8183 | −.0764 |
| −4.8756 | −.4572 | .8401 | −.0695 |
| −4.8399 | −.4298 | .8607 | −.0628 |
| −4.8067 | −.4027 | .8801 | −.0565 |
| −4.7761 | −.3762 | .8983 | −.0506 |
| −4.7479 | −.3501 | .9154 | −.0450 |
| −4.7219 | −.3244 | .9313 | −.0398 |
| −4.6979 | −.2988 | .9463 | −.0349 |
| −4.6760 | −.2736 | .9600 | −.0303 |
| −4.6561 | −.2487 | .9727 | −.0261 |
| −4.6380 | −.2241 | .9843 | −.0223 |
| −4.6217 | −.1996 | .9949 | −.0187 |
| −4.6069 | −.1751 | 1.0046 | −.0155 |
| −4.5940 | −.1509 | 1.0131 | −.0126 |
| −4.5826 | −.1268 | 1.0206 | −.0100 |
| −4.5727 | −.1028 | 1.0271 | −.0077 |
| −4.5643 | −.0787 | 1.0326 | −.0058 |
| −4.5573 | −.0548 | 1.0371 | −.0041 |
| −4.5518 | −.0309 | 1.0406 | −.0027 |
| −4.5477 | −.0071 | 1.0431 | −.0016 |
| −4.5448 | .0168 | 1.0447 | −.0008 |
| −4.5433 | .0409 | 1.0452 | −.0003 |
| −4.5431 | .0649 | 1.0447 | .0000 |
| −4.5435 | .0769 | 1.0441 | .0000 |