NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

TECHNICAL NOTE 2479

TABLES OF EXACT LAMINAR-BOUNDARY-LAYER SOLUTIONS WHEN THE WALL IS POROUS AND FLUID PROPERTIES ARE VARIABLE

By W. Byron Brown and Patrick L. Donoughe

Lewis Flight Propulsion Laboratory
Cleveland, Ohio

Washington
September 1951

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

TECHNICAL NOTE 2479

TABLES OF EXACT LAMINAR-BOUNDARY-LAYER SOLUTIONS WHEN THE WALL IS POROUS AND FLUID PROPERTIES ARE VARIABLE

By W. Byron Brown and Patrick L. Donoughe

SUMMARY

The three partial differential equations of the laminar boundary layer for two-dimensional steady-state compressible flow have been transformed into two ordinary differential equations by the method of Pohlhausen, Falkner, and Skan. The ordinary equations include parameters for expressing the simultaneous effects of pressure gradient in the main-stream flow through a porous wall and property changes in the fluid due to large temperature differences between the wall and the free stream.

A total of 58 cases have been solved numerically by the method of Picard. The Euler number (nondimensional pressure-gradient parameter) ranges in value from 1 (stagnation-point value) to the negative values found at the laminar separation points. Three rates of flow through the porous wall were considered (including the impermeable case where the flow rate is 0). Five temperature ratios (stream temperature divided by wall temperature) were used: the uncooled and unheated case (temperature ratio of 1), two cooled cases (temperature ratios of 2 and 4), and (for the impermeable wall only) two heated cases (temperature ratios of 1/2 and 1/4). Velocity, weight-flow, and temperature distributions are tabulated as are the dimensionless stream function of Falkner and Skan and its derivatives and the dimensionless temperature function of Pohlhausen and its derivatives.

For each case, displacement, momentum, and convection thicknesses, as well as Nusselt number and coefficient of friction at the wall, were computed.

INTRODUCTION

A method of solving the laminar boundary-layer equations in which the fluid properties change with the temperature, the pressure varies along the main stream, and the cooling air flows through a porous wall is given in reference 1. Only temperature ratios (ratio of stream to wall temperature) greater than 1 (cooling) were considered therein. Since that time, additional solutions have been obtained for temperature ratios less than 1 (heating) for an impermeable wall.

Results of an investigation at the NACA Lewis laboratory are tabulated herein from solutions of different combinations of temperature ratios for heating and cooling, pressure gradients in the direction of the main flow, and coolant flows through the porous wall. These tables include velocity, weight-flow (product of density times velocity), and temperature distributions as well as the dimensionless stream and temperature functions and their derivatives. In addition, dimensionless forms of displacement, momentum, and convection boundary-layer thicknesses, Nusselt numbers, and wall friction coefficients are given for each case considered.

The numerical tables which give the distributions of the velocity and temperature functions are the work of Mrs. Helen C. Desmon and her associates.

SYMBOLS

The following symbols are used in this report:

C	constant of proportionality
$C_{f,w}$	$\frac{\tau_w}{\frac{\rho_w U_\infty^2}{2}}$
$C_{f,\infty}$	$\frac{\tau_w}{\frac{\rho_\infty U_\infty^2}{2}}$
c_p	specific heat at constant pressure
Eu	Euler number, $\frac{-x\frac{dp}{dx}}{\rho_\infty U_\infty^2}$; $U_\infty = Cx^{Eu}$
f	dimensionless stream function
f', f'', f'''	first, second, and third derivatives of f with respect to η

k	thermal conductivity
Nu	Nusselt number, $\frac{Hx}{k_w}$
P	$\frac{T}{T_w} = 1 + \theta\left(\frac{T_\infty}{T_w} - 1\right) = P$
p	pressure
Pr	Prandtl number, $\frac{c_{pw}\,\mu_w}{k_w}$
Re	Reynolds number, $\frac{U_\infty \rho_w\, x}{\mu_w}$
T	fluid temperature
T_w	refers to wall temperature and coolant upon emergence from porous wall
U_∞	fluid velocity at edge of boundary layer
u	fluid velocity in boundary layer in x-direction parallel to wall
v	fluid velocity in boundary layer in y-direction normal to wall
x	distance along surface
y	distance normal to surface
α	exponent of temperature for specific heat, $c_p \propto T^\alpha$
β	pressure-gradient parameter, $\frac{2Eu}{Eu+1}$
δ^*	displacement boundary-layer thickness
δ_c	convection boundary-layer thickness
δ_i	momentum boundary-layer thickness
ϵ	exponent of temperature for thermal conductivity, $k \propto T^\epsilon$
η	dimensionless boundary-layer coordinate, $y\sqrt{\frac{\rho_w U_\infty}{\mu_w x}}$
θ	temperature-difference ratio, $\frac{T-T_w}{T_\infty-T_w}$

θ', θ''	first and second derivatives of θ with respect to η
μ	absolute viscosity of fluid
ρ	density of fluid
τ_w	shear stress at wall
ψ	stream function
ω	exponent of temperature for viscosity, $\mu \propto T^{\omega}$

Subscripts:

w	wall
∞	main stream

ANALYSIS

The equations of the laminar boundary layer for steady-state flow of a viscous fluid with heat transfer may be obtained from reference 1 as

Momentum equation:

$$\rho u \frac{\partial u}{\partial x} + \rho v \frac{\partial u}{\partial y} = \frac{\partial}{\partial y}\left(\mu \frac{\partial u}{\partial y}\right) - \frac{\partial p}{\partial x} \tag{1}$$

Continuity equation:

$$\frac{\partial(\rho u)}{\partial x} + \frac{\partial(\rho v)}{\partial y} = 0 \tag{2}$$

Energy equation:

$$c_p\left(\rho u \frac{\partial T}{\partial x} + \rho v \frac{\partial T}{\partial y}\right) = \frac{\partial}{\partial y}\left(k \frac{\partial T}{\partial y}\right) + \mu\left(\frac{\partial u}{\partial y}\right)^2 + u \frac{\partial p}{\partial x} \tag{3}$$

The boundary conditions are: when $y = 0$,

$$u = 0 \qquad v = v_w \qquad T = T_w$$

and when $y \to \infty$,

$$u \to U_\infty \qquad \frac{\partial u}{\partial y} \to 0 \qquad T \to T_\infty \qquad \frac{\partial T}{\partial y} \to 0 \tag{4}$$

Assumptions

In order to simplify the analysis, the following assumptions are made:

(1) The Mach number is small.

(2) The Euler number is constant.

(3) The wall temperature is constant.

(4) The fluid property variations are expressible as some power of the absolute temperature:

$$\mu \propto T^{\omega} \qquad k \propto T^{\epsilon} \qquad c_p \propto T^{\alpha} \qquad \rho \propto T^{-1} \tag{5}$$

Transformation to Ordinary Differential Equations

The transformation from partial to total differential equations is accomplished by the change in variables

$$\left.\begin{aligned} \eta &= y\sqrt{\frac{\rho_w U_\infty}{\mu_x x}} \\ \theta &= \frac{T-T_w}{T_\infty-T_w} \end{aligned}\right\} \tag{6}$$

and

$$f = \frac{\rho_w \psi}{\sqrt{\mu_w x U_\infty \rho_w}}$$

where η is the dimensionless independent variable introduced by Blasius, and f and θ are the dimensionless dependent variables representing the stream function and temperature, respectively.

Substitution of η, f, and θ in the partial differential equations and use of the simplifying assumptions yield (reference 1) the energy equation

$$-\theta'' = \frac{Eu+1}{2} Pr_w P^{\alpha-\epsilon} \theta' f + \epsilon\left(\frac{T_\infty}{T_w} - 1\right) P^{-1} \theta'^2 \tag{7}$$

and the momentum equation

$$f''' = Eu\, P^{-\omega} f'^2 - \frac{Eu+1}{2} P^{-\omega} ff'' - Eu \frac{T_w}{T_\infty} P^{-\omega-1} -$$

$$\frac{Eu+1}{2}\left(\frac{T_\infty}{T_w} - 1\right) P^{-\omega-1} ff'\theta' - \left(\frac{T_\infty}{T_w} - 1\right) P^{-1} f'\theta'' -$$

$$(\omega+2)\left(\frac{T_\infty}{T_w} - 1\right) P^{-1} f''\theta' - \omega\left(\frac{T_\infty}{T_w} - 1\right)^2 P^{-2} f'\theta'^2 \qquad (8)$$

The boundary conditions are: when $\eta = 0$,

$$f' = 0 \qquad f = f_w \qquad \theta = 0$$

and when $\eta \to \infty$,

$$\theta \to 1 \qquad \theta' \to 0 \qquad f' \to \frac{T_w}{T_\infty} \qquad f'' \to 0 \qquad (9)$$

CALCULATION OF TABLES

In the solution of equations (7) and (8), air in the range of 600° to 2400° F was chosen as the fluid for the main stream and the coolant forced through the porous wall was assumed to be air. Thus Pr_w was taken at 0.7, the exponent ω in the viscosity-temperature relation was 0.7, the exponent ϵ in the thermal-conductivity temperature relation was 0.85, and the exponent α in the specific heat-temperature relation was 0.19.

In the first six cases (table I(1)), the velocity distributions had already been calculated in reference 2. In these cases, the wall was impermeable ($f_w = 0$) and the fluid properties were constant ($T_\infty/T_w = 1$). The energy equation (1) thus reduced to the simple form

$$-\theta'' = \frac{Eu+1}{2} Pr_w\, \theta' f \qquad (10)$$

This is a linear equation of the first order and hence is readily solved after f is found by a numerical integration of the velocity distributions. The solution given in reference 3 is

$$\theta = \frac{\int_0^{\eta} e^{-\frac{Eu+1}{2} Pr_w \int_0^{\eta} f\, d\eta}\, d\eta}{\int_0^{\infty} e^{-\frac{Eu+1}{2} Pr_w \int_0^{\eta} f\, d\eta}\, d\eta} \tag{11}$$

The Blasius and Pohlhausen distributions are given in table I(2).

Then θ and u/U_∞ were tabulated as functions of η. The value of $Nu/\sqrt{Re}$ was given by the reciprocal of the denominator of equation (11); that is

$$\frac{Nu}{\sqrt{Re}} = \frac{1}{\int_0^{\infty} e^{-\frac{Eu+1}{2} Pr_w \int_0^{\eta} f\, d\eta}\, d\eta} = \theta_w' \tag{12}$$

The value of f_w'' was taken from reference 2.

The three thicknesses were computed from the equations derived in reference 1:

$$\left.\begin{aligned} \frac{\delta^*}{x}\sqrt{Re} &= \int_0^{\infty} \left(1 - \frac{T_\infty}{T_w} f'\right) d\eta \\ \frac{\delta_i}{x}\sqrt{Re} &= \frac{T_\infty}{T_w} \int_0^{\infty} f'(1-Pf')\, d\eta \\ \frac{\delta_c}{x}\sqrt{Re} &= \frac{T_\infty}{T_w} \int_0^{\infty} f'(1-\theta)\, d\eta \end{aligned}\right\} \tag{13}$$

The remaining parts of table I contain the values of f, f', f'', and f''' and θ, θ', and θ''. These values were obtained by solving equations (7) and (8) numerically by the method of Picard, as explained in reference 1. The thicknesses were computed by equations (13) as before.

When the temperature ratio was 1, u/U_∞ was given by the f' table, as follows from equation (6) with $P = 1$. When $T_\infty/T_w \neq 1$,

$$\frac{u}{U_\infty} = f'\left[1 + \theta\left(\frac{T_\infty}{T_w} - 1\right)\right] = f'P \qquad (14)$$

2240

and $\rho u/\rho_\infty U_\infty$ was given by $f' T_\infty/T_w$ obtained by multiplying equation (14) by ρ/ρ_∞ or T_∞/T.

From reference 1 also,

$$\frac{Nu}{\sqrt{Re}} = \theta'_w$$

A summary of the principal parameters is given in table II, which serves as an index to table I. Here all the thicknesses are grouped together with the values of $Nu/\sqrt{Re}$ and of f''_w. If C_f is defined by the equation

$$\tau_w = \frac{1}{2} C_{f,w} \rho_w U_\infty^2$$

then

$$f''_w = \frac{C_{f,w}}{2}\sqrt{Re}$$

Conversely, if C_f is defined by the relation

$$\tau_w = \frac{1}{2} C_{f,\infty} \rho_\infty U_\infty^2$$

then

$$f''_w = \frac{C_{f,\infty}}{2}\frac{T_w}{T_\infty}\sqrt{Re}$$

DISCUSSION

For the case of the heated wall ($T_\infty/T_w = 1/2, 1/4$), the boundary-layer velocity was found to be higher than the stream velocity for Euler numbers 0.5 and 1 with no coolant flow. This apparent anomaly is probably due to the high pressure gradient imposed on the flow in conjunction with the large amount of heating at the wall. The velocity distributions for heating and cooling are shown in figure 1 for the impermeable wall and an Euler number of 1. The calculation for the momentum thicknesses yielded negative values for temperature ratio of 1/4 with Eu = 0.5 and 1.0 (table II).

The values of the Euler number at the separation point are plotted against the temperature ratio for the impermeable wall in figure 2. This curve is obtained by setting $f''_w = 0$ for each temperature ratio. The value for temperature ratio of 1 was obtained by Hartree (reference 2). Increasing the temperature ratio from 1 to 4 permits a 50 percent greater adverse pressure gradient, whereas reducing it from 1 to 1/4 decreases the permissible adverse pressure gradient by about 60 percent.

CONCLUDING REMARKS

Calculations of 58 velocity and temperature distributions were made for air with a low Mach number by equations that include the simultaneous effects of pressure gradients in the main stream, flow through a porous wall, and large temperature variations through the boundary layer.

The pressure gradients vary from stagnation point values (Euler number of 1) to the values occurring at the laminar separation point. Three rates of flow through the porous wall, represented by 0, -0.5, and -1, have been used; three values of the ratio of stream to wall temperature have been used throughout, 1, 2, and 4. For the impermeable wall, two additional ratios were used, 1/2 and 1/4.

For each case, a complete tabulation throughout the boundary layer was made of velocity, weight-flow, and temperature distributions, as well as of the nondimensional stream and temperature functions and their derivatives.

Each case determines a value for the Nusselt number, the wall friction coefficient, and the displacement, momentum, and convection thicknesses.

When the wall is much hotter than the stream and large favorable pressure gradients exist, boundary-layer velocities may exceed the free-stream values by amounts ranging as high as 20 percent (near the stagnation point when the wall temperature is four times the stream temperature). For some of the heated-wall profiles, the momentum thicknesses are negative; that is, the boundary layer contains more energy than a corresponding section of the free stream.

Lewis Flight Propulsion Laboratory,
National Advisory Committee for Aeronautics,
Cleveland, Ohio, May 31, 1951.

REFERENCES

1. Brown, W. Byron: Exact Solutions of the Laminar Boundary Layer Equations for a Porous Plate with Variable Fluid Properties and a Pressure Gradient in the Main Stream. Paper presented before the First U. S. National Congress of Applied Mechanics. Chicago, Ill., June 11-16, 1951.

2. Hartree, D. R.: On an Equation Occurring in Falkner and Skan's Approximate Treatment of the Equations of the Boundary Layer. Proc. Cambridge Phil. Soc., vol. 33, pt. 2, April 1937, pp. 223-239.

3. Eckert, E., and Drewitz, O.: Calculation of the Temperature Field in the Laminar Boundary Layer of an Unheated Body in a High Speed Flow. R.T.P. Trans. No. 1594, British M.A.P.

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL

(1) $f_w = 0$; $T_\infty/T_w = 1$

$\frac{Nu}{\sqrt{Re}} = 0.231$	$\frac{Nu}{\sqrt{Re}} = 0.221$	$\frac{Nu}{\sqrt{Re}} = 0.198$
$f''_w = .087$	$f''_w = .058$	$f''_w = 0$
$\frac{\delta^*\sqrt{Re}}{x} = 2.762$	$\frac{\delta^*\sqrt{Re}}{x} = 2.972$	$\frac{\delta^*\sqrt{Re}}{x} = 3.498$
$\frac{\delta_1\sqrt{Re}}{x} = .838$	$\frac{\delta_1\sqrt{Re}}{x} = .853$	$\frac{\delta_1\sqrt{Re}}{x} = .868$
$\frac{\delta_c\sqrt{Re}}{x} = .720$	$\frac{\delta_c\sqrt{Re}}{x} = .693$	$\frac{\delta_c\sqrt{Re}}{x} = .626$
Eu=-0.0826 β=-0.18	Eu=-0.0868 β=-0.19	Eu=-0.0904 β=-0.1988

η	θ	u/U_∞[1]	η	θ	u/U_∞[1]	η	θ	u/U_∞[1]
0	0	0	0	0	0	0	0	0
.295	.068	.029	.296	.066	.021	.297	.059	.004
.591	.136	.066	.592	.131	.050	.593	.118	.016
.886	.204	.109	.888	.196	.086	.890	.177	.036
1.181	.272	.160	1.184	.262	.129	1.186	.236	.064
1.476	.340	.217	1.480	.326	.179	1.483	.295	.099
1.772	.406	.279	1.776	.391	.236	1.779	.354	.142
2.067	.471	.346	2.072	.454	.299	2.076	.412	.193
2.362	.534	.417	2.368	.515	.366	2.372	.469	.250
2.658	.595	.490	2.664	.575	.437	2.669	.526	.313
2.953	.652	.562	2.960	.632	.510	2.966	.580	.380
3.248	.706	.633	3.256	.686	.581	3.262	.633	.451
3.543	.756	.700	3.552	.736	.651	3.559	.684	.523
3.839	.801	.760	3.848	.782	.716	3.855	.731	.595
4.134	.840	.815	4.144	.823	.775	4.152	.775	.664
4.429	.874	.861	4.440	.859	.827	4.448	.815	.728
4.725	.903	.899	4.736	.890	.871	4.745	.850	.786
5.020	.927	.929	5.032	.916	.907	5.042	.881	.836
5.315	.946	.952	5.328	.937	.935	5.338	.908	.879
5.611	.962	.968	5.624	.954	.956	5.635	.930	.913
5.906	.973	.980	5.920	.967	.972	5.931	.948	.940
6.201	.981	.988	6.216	.977	.982	6.228	.962	.960
6.496	.988	.993	6.512	.984	.989	6.524	.973	.974
6.792	.992	.996	6.808	.990	.994	6.821	.981	.984
7.087	.995	.998	7.104	.993	.996	7.117	.987	.990
7.382	.997	.999	7.400	.996	.998	7.414	.992	.994
7.678	.998	.999	7.696	.997	.999	7.711	.995	.997
7.973	.999	1.000	7.992	.998	1.000	8.007	.997	.998
8.268	.999	1.000	8.288	.999	1.000	8.304	.998	.999
8.563	1.000	1.000	8.584	1.000	1.000	8.600	.999	1.000
8.859	1.000	1.000	8.880	1.000	1.000	8.897	.999	1.000
9.154	1.000		9.176	1.000	1.000	9.193	1.000	1.000
9.449	1.000		9.472	1.000		9.490	1.000	1.000
9.745	1.000		9.768	1.000		9.786	1.000	
10.040	1.000		10.064	1.000		10.083	1.000	
			10.360	1.000		10.380	1.000	
						10.676	1.000	
						10.973	1.000	

[1]Hartree

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(l) $f_w = 0$; $T_\infty/T_w = 1$ - Concluded

$\frac{Nu}{\sqrt{Re}} = 0.267$	$\frac{Nu}{\sqrt{Re}} = 0.253$	$\frac{Nu}{\sqrt{Re}} = 0.243$
$f''_w = .220$	$f''_w = .164$	$f''_w = .130$
$\frac{\delta^*\sqrt{Re}}{x} = .092$	$\frac{\delta^*\sqrt{Re}}{x} = 2.336$	$\frac{\delta^*\sqrt{Re}}{x} = 2.510$
$\frac{\delta_1\sqrt{Re}}{x} = .746$	$\frac{\delta_1\sqrt{Re}}{x} = .788$	$\frac{\delta_1\sqrt{Re}}{x} = .812$
$\frac{\delta_c\sqrt{Re}}{x} = .801$	$\frac{\delta_c\sqrt{Re}}{x} = .773$	$\frac{\delta_c\sqrt{Re}}{x} = .752$

Eu=-0.0476 β=-0.10			Eu=-0.0654 β=-0.14			Eu=-0.0741 β=-0.16		
η	θ	u/U_∞[1]	η	θ	u/U_∞[1]	η	θ	u/U_∞[1]
0	0	0	0	0	0	0	0	0
.290	.077	.066	.293	.074	.051	.294	.072	.041
.580	.155	.136	.585	.148	.107	.588	.143	.089
.869	.232	.209	.878	.222	.168	.882	.214	.143
1.159	.308	.285	1.170	.295	.235	1.176	.285	.202
1.449	.383	.363	1.463	.367	.305	1.470	.356	.267
1.739	.456	.442	1.755	.438	.378	1.764	.425	.336
2.029	.527	.519	2.048	.506	.453	2.058	.492	.408
2.319	.594	.595	2.341	.572	.528	2.352	.557	.482
2.608	.658	.666	2.633	.635	.602	2.646	.619	.556
2.898	.716	.731	2.926	.693	.671	2.939	.677	.627
3.188	.768	.790	3.218	.746	.735	3.233	.730	.694
3.478	.814	.840	3.511	.794	.793	3.527	.779	.756
3.768	.854	.882	3.803	.836	.842	3.821	.822	.811
4.057	.888	.915	4.096	.872	.884	4.115	.860	.857
4.347	.916	.941	4.389	.902	.917	4.409	.892	.896
4.637	.938	.961	4.681	.927	.942	4.703	.918	.926
4.927	.956	.975	4.974	.947	.962	4.997	.939	.950
5.217	.969	.984	5.266	.962	.975	5.291	.956	.967
5.506	.979	.990	5.559	.974	.984	5.585	.969	.979
5.796	.986	.994	5.851	.982	.991	5.879	.979	.987
6.086	.991	.997	6.144	.988	.995	6.173	.986	.992
6.376	.994	.998	6.437	.992	.997	6.467	.991	.996
6.666	.996	.999	6.729	.995	.998	6.761	.994	.998
6.956	.998	1.000	7.022	.997	.999	7.055	.996	.999
7.245	.999	1.000	7.314	.998	1.000	7.349	.998	.999
7.535	.999	1.000	7.607	.999	1.000	7.643	.999	1.000
7.825	1.000	1.000	7.899	.999	1.000	7.936	.999	1.000
8.115	1.000		8.192	1.000	1.000	8.230	1.000	1.000
8.405	1.000		8.484	1.000		8.524	1.000	1.000
8.694	1.000		8.777	1.000		8.818	1.000	
8.984	1.000		9.070	1.000		9.112	1.000	
9.274	1.000		9.362	1.000		9.406	1.000	
			9.655	1.000		9.700	1.000	
						9.994	1.000	

[1]Hartree

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(2) $T_\infty/T_w = 1$; $Eu = 0$; $f_w = 0$ [1]

$\frac{\delta^*\sqrt{Re}}{x} = 1.721$; $\frac{\delta_i\sqrt{Re}}{x} = 0.662$; $\frac{\delta_c\sqrt{Re}}{x} = 0.834$

η	f	f'	f''	f'''	θ	θ'	θ''
0	0	0	0.332	0	0	0.293	0
.4	.027	.133	.332	-.004	.117	.292	-.003
.8	.106	.264	.328	-.017	.234	.290	-.011
1.2	.238	.394	.316	-.038	.348	.283	-.024
1.6	.420	.517	.297	-.062	.459	.270	-.040
2.0	.650	.630	.267	-.087	.564	.251	-.057
2.4	.922	.729	.228	-.105	.659	.225	-.073
2.8	1.231	.812	.184	-.113	.743	.194	-.083
3.2	1.569	.876	.139	-.109	.814	.159	-.087
3.6	1.930	.924	.098	-.095	.870	.125	-.084
4.0	2.306	.956	.064	-.074	.914	.093	-.075
4.4	2.692	.976	.039	-.052	.945	.065	-.062
4.8	3.085	.988	.022	-.034	.967	.044	-.047
5.2	3.481	.994	.011	-.020	.981	.028	-.034
5.6	3.880	.998	.006	-.010	.989	.016	-.022
6.0	4.280	.999	.002	-.005	.994	.009	-.014
6.4	4.679	1.000	.001	-.002	.997	.005	-.008
6.8	5.079	1.000	.000	-.001	.999	.002	-.004
7.2	5.479	1.000	.000	.000	.999	.001	-.002
7.6	5.879	1.000	.000	.000	1.000	.000	-.001
8.0	6.279	1.000	.000	.000	1.000	.000	.000
8.4	6.679				1.000	.000	.000
8.8	7.079				1.000	.000	.000
9.2	7.479				1.000	.000	.000

[1] Blasius

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(3) $T_\infty/T_W = 1$; $Eu = 0.5$; $f_W = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.855$; $\frac{\delta_1\sqrt{Re}}{x} = 0.374$; $\frac{\delta_c\sqrt{Re}}{x} = 0.792$

η	f	f'	f''	f'''	θ	θ'	θ''
0	0	0	0.900	-0.500	0	0.416	0
.2	.017	.170	.800	-.496	.083	.416	-.004
.4	.067	.320	.702	-.484	.166	.414	-.014
.6	.144	.451	.607	-.464	.249	.410	-.031
.8	.246	.563	.517	-.437	.330	.401	-.052
1.0	.368	.658	.433	-.403	.409	.389	-.075
1.2	.508	.737	.356	-.364	.485	.371	-.099
1.4	.662	.801	.287	-.322	.557	.349	-.121
1.6	.827	.852	.227	-.278	.624	.323	-.140
1.8	1.002	.892	.176	-.234	.686	.294	-.154
2.0	1.184	.923	.134	-.192	.742	.262	-.163
2.2	1.371	.946	.099	-.154	.791	.229	-.165
2.4	1.562	.963	.072	-.120	.833	.196	-.161
2.6	1.756	.976	.051	-.091	.870	.165	-.152
2.8	1.952	.984	.035	-.067	.900	.136	-.139
3.0	2.149	.990	.024	-.048	.924	.109	-.123
3.2	2.348	.994	.016	-.034	.944	.086	-.107
3.4	2.546	.996	.010	-.023	.959	.067	-.089
3.6	2.746	.998	.006	-.015	.970	.051	-.073
3.8	2.946	.999	.004	-.009	.979	.038	-.058
4.0	3.145	.999	.002	-.006	.986	.027	-.045
4.2	3.345	1.000	.001	-.004	.990	.019	-.034
4.4	3.545	1.000	.001	-.002	.994	.014	-.025
4.6	3.745	1.000	.000	-.001	.996	.009	-.018
4.8	3.945	1.000	.000	-.001	.997	.006	-.013
5.0	4.145	1.000	.000	.000	.998	.004	-.009
5.2	4.345	1.000	.000	.000	.999	.003	-.006
5.4	4.545				.999	.002	-.004
5.6	4.745				1.000	.001	-.002
5.8	4.945				1.000	.001	-.002
6.0	5.145				1.000	.000	-.001
6.2	5.345				1.000	.000	-.001
6.4	5.545				1.000	.000	.000
6.6	5.745				1.000	.000	.000
6.8	5.945				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(4) $T_\infty/T_W = 1$; Eu = 1; $f_W = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.648$; $\frac{\delta_1\sqrt{Re}}{x} = 0.290$; $\frac{\delta_c\sqrt{Re}}{x} = 0.708$

η	f	f'	f''	f'''	θ	θ'	θ''
0	0	0	1.233	-1.000	0	0.496	0
.1	.006	.118	1.133	-.993	.050	.496	-.002
.2	.023	.227	1.034	-.973	.099	.495	-.008
.3	.051	.325	.939	-.942	.149	.494	-.018
.4	.088	.414	.846	-.903	.198	.492	-.030
.5	.134	.495	.758	-.857	.247	.488	-.046
.6	.187	.566	.675	-.806	.295	.482	-.063
.7	.247	.630	.597	-.751	.343	.475	-.082
.8	.312	.686	.525	-.694	.390	.466	-.102
.9	.384	.735	.459	-.636	.436	.455	-.122
1.0	.459	.778	.398	-.578	.481	.442	-.142
1.1	.539	.815	.343	-.521	.525	.426	-.161
1.2	.622	.847	.294	-.466	.566	.409	-.178
1.3	.708	.874	.250	-.413	.606	.391	-.194
1.4	.797	.897	.211	-.364	.645	.371	-.207
1.5	.887	.916	.177	-.318	.681	.350	-.217
1.6	.980	.932	.147	-.275	.714	.327	-.225
1.7	1.074	.946	.122	-.236	.746	.305	-.229
1.8	1.169	.957	.100	-.201	.775	.282	-.230
1.9	1.265	.966	.081	-.170	.802	.259	-.229
2.0	1.362	.973	.066	-.142	.827	.236	-.225
2.1	1.460	.979	.053	-.118	.850	.214	-.218
2.2	1.558	.984	.042	-.097	.870	.192	-.210
2.3	1.656	.988	.033	-.080	.888	.172	-.199
2.4	1.755	.990	.026	-.064	.904	.153	-.188
2.5	1.854	.993	.020	-.052	.919	.134	-.175
2.6	1.954	.995	.016	-.041	.931	.118	-.161
2.7	2.053	.996	.012	-.032	.942	.102	-.147
2.8	2.153	.997	.009	-.025	.952	.088	-.133
2.9	2.253	.998	.007	-.020	.960	.076	-.119
3.0	2.352	.998	.005	-.015	.967	.064	-.106
3.1	2.452	.999	.004	-.011	.973	.054	-.093
3.2	2.552	.999	.003	-.008	.978	.046	-.082
3.3	2.652	.999	.002	-.007	.982	.038	-.071
3.4	2.752	1.000	.002	-.006	.986	.032	-.061
3.5	2.852	1.000	.001	-.005	.988	.026	-.052
3.6	2.952	1.000	.001	-.003	.991	.021	-.044
3.7	3.052	1.000	.001	-.003	.993	.017	-.037
3.8	3.152	1.000	.000	-.002	.994	.014	-.030
3.9	3.252	1.000	.000	-.001	.996	.011	-.025
4.0	3.352	1.000	.000	-.001	.997	.009	-.020
4.1	3.452	1.000	.000	.000	.997	.007	-.017
4.2	3.552	1.000	.000	.000	.998	.005	-.013
4.3	3.652	1.000	.000	.000	.998	.004	-.011
4.4	3.752				.999	.003	-.008
4.5	3.852				.999	.002	-.007
4.6	3.952				.999	.002	-.005
4.7	4.052				1.000	.001	-.004
4.8	4.152				1.000	.001	-.003
4.9	4.252				1.000	.001	-.002
5.0	4.352				1.000	.001	-.002
5.1	4.452				1.000	.000	-.001
5.2	4.552				1.000	.000	-.001
5.3	4.652				1.000	.000	.001
5.4	4.752				1.000	.000	.001
5.5	4.852				1.000	.000	.000

2240

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(5) $T_\infty/T_w = 2$; Eu = -0.1178; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 4.582$; $\frac{\delta_1\sqrt{Re}}{x} = 1.664$; $\frac{\delta_c\sqrt{Re}}{x} = 1.076$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0	0.059	0	0.189	-0.030	0	0
.2	.000	.001	.011	.050	.037	.183	-.028	.001	.002
.4	.001	.004	.020	.043	.073	.178	-.025	.004	.008
.6	.002	.009	.028	.038	.109	.173	-.023	.010	.018
.8	.004	.016	.035	.033	.143	.169	-.021	.018	.031
1.0	.008	.023	.042	.029	.176	.165	-.020	.027	.046
1.2	.014	.032	.047	.026	.209	.161	-.019	.039	.064
1.4	.021	.042	.052	.023	.241	.157	-.018	.052	.084
1.6	.030	.053	.056	.020	.272	.154	-.017	.067	.106
1.8	.042	.064	.060	.018	.302	.150	-.016	.084	.129
2.0	.056	.077	.063	.016	.332	.147	-.016	.102	.153
2.2	.073	.090	.066	.014	.361	.144	-.016	.122	.179
2.4	.092	.103	.068	.012	.390	.141	-.015	.143	.206
2.6	.114	.117	.071	.010	.417	.138	-.015	.166	.234
2.8	.139	.131	.072	.008	.445	.135	-.015	.190	.262
3.2	.197	.161	.075	.005	.497	.129	-.015	.241	.322
3.6	.268	.191	.076	.002	.548	.123	-.016	.296	.382
4.0	.350	.222	.076	-.001	.596	.116	-.016	.354	.443
4.4	.445	.252	.075	-.004	.641	.110	-.017	.414	.504
4.8	.552	.282	.073	-.007	.683	.103	-.018	.474	.564
5.2	.670	.310	.070	-.010	.723	.095	-.018	.535	.621
5.6	.800	.337	.065	-.012	.760	.088	-.019	.594	.675
6.0	.940	.362	.060	-.014	.793	.080	-.019	.650	.725
6.4	1.090	.385	.054	-.015	.824	.073	-.019	.703	.771
6.8	1.248	.406	.048	-.015	.851	.065	-.019	.752	.812
7.2	1.414	.424	.042	-.015	.876	.058	-.018	.796	.848
7.6	1.587	.440	.036	-.015	.898	.051	-.017	.835	.880
8.0	1.766	.453	.030	-.014	.916	.044	-.016	.869	.907
8.4	1.949	.464	.025	-.013	.933	.037	-.015	.898	.929
8.8	2.137	.474	.020	-.012	.946	.032	-.014	.922	.947
9.2	2.328	.481	.016	-.010	.958	.026	-.012	.941	.962
9.6	2.522	.486	.012	-.008	.968	.022	-.011	.957	.973
10.0	2.717	.491	.009	-.007	.975	.017	-.010	.969	.981
10.4	2.914	.494	.007	-.006	.982	.014	-.008	.978	.988
10.8	3.112	.496	.005	-.004	.987	.011	-.007	.985	.992
11.2	3.311	.498	.003	-.003	.990	.008	-.005	.990	.995
11.6	3.510	.499	.002	-.002	.993	.006	-.004	.994	.997
12.0	3.710	.499	.001	-.002	.996	.005	-.003	.996	.999
12.4	3.909	.500	.001	-.001	.997	.004	-.003	.998	.999
12.8	4.109	.500	.000	-.001	.998	.003	-.002	.999	1.000
13.2	4.309	.500	.000	.000	.999	.002	-.002	1.000	1.000
13.6	4.509	.500	.000	.000	1.000	.001	-.001	1.000	1.000
14.0	4.709	.500	.000	.000	1.000	.001	-.001	1.000	1.000
14.4	4.909				1.000	.000	-.001	1.000	
14.8	5.109				1.000	.000	.000	1.000	
15.2	5.309				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(6) $T_\infty/T_w = 2$; Eu = -0.09; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 2.430$; $\frac{\delta_i\sqrt{Re}}{x} = 1.501$; $\frac{\delta_c\sqrt{Re}}{x} = 1.408$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.163	-0.066	0	0.252	-0.054	0	0
.1	.001	.016	.157	-.059	.025	.247	-.051	.016	.032
.2	.003	.031	.152	-.053	.049	.242	-.048	.033	.063
.3	.007	.046	.146	-.048	.073	.237	-.045	.050	.093
.4	.012	.061	.142	-.044	.097	.233	-.043	.067	.121
.5	.019	.075	.138	-.040	.120	.229	-.041	.084	.149
.6	.028	.088	.134	-.037	.143	.225	-.039	.101	.177
.7	.037	.102	.130	-.034	.165	.221	-.038	.118	.203
.8	.048	.114	.127	-.032	.187	.217	-.037	.136	.229
.9	.060	.127	.124	-.030	.209	.214	-.036	.154	.254
1.0	.073	.139	.121	-.029	.230	.210	-.035	.171	.278
1.2	.103	.163	.115	-.026	.271	.203	-.033	.207	.326
1.4	.138	.185	.110	-.024	.311	.197	-.032	.243	.371
1.6	.178	.207	.106	-.023	.350	.190	-.031	.280	.414
1.8	.221	.228	.101	-.022	.387	.184	-.031	.316	.455
2.0	.268	.248	.097	-.022	.424	.178	-.031	.352	.495
2.2	.320	.266	.092	-.021	.459	.172	-.031	.389	.533
2.4	.375	.284	.088	-.021	.492	.165	-.031	.425	.569
2.6	.434	.302	.084	-.021	.525	.159	-.031	.460	.603
2.8	.496	.318	.080	-.021	.556	.153	-.031	.495	.636
3.2	.629	.348	.071	-.021	.615	.141	-.031	.562	.697
3.6	.774	.375	.063	-.020	.669	.128	-.031	.626	.750
4.0	.929	.399	.055	-.020	.717	.116	-.031	.685	.798
4.4	1.092	.419	.047	-.019	.761	.104	-.030	.739	.839
4.8	1.264	.437	.040	-.018	.801	.092	-.029	.787	.874
5.2	1.442	.452	.033	-.016	.835	.080	-.028	.828	.903
5.6	1.625	.464	.027	-.015	.865	.070	-.026	.864	.927
6.4	2.003	.481	.017	-.011	.913	.050	-.022	.920	.962
7.2	2.392	.491	.009	-.008	.946	.034	-.018	.956	.982
8.0	2.787	.496	.004	-.004	.969	.022	-.013	.977	.993
8.8	3.186	.499	.002	-.002	.983	.014	-.009	.989	.998
9.6	3.585	.500	.000	-.001	.991	.008	-.006	.995	.999
10.4	3.985	.500	.000	.000	.996	.004	-.003	.998	1.000
11.2	4.385				.998	.002	-.002	.999	
12.0	4.785				.999	.001	-.001	1.000	
12.8	5.185				1.000	.000	.000	1.000	
13.6	5.585				1.000	.000	.000	1.000	
14.4	5.985				1.000	.000	.000	1.000	
15.2	6.385				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(7) $T_\infty/T_w = 2$; $Eu = -0.05$; $f_w = 0$

$\frac{\delta^* \sqrt{Re}}{x} = 1.882$; $\frac{\delta_1 \sqrt{Re}}{x} = 1.383$; $\frac{\delta_c \sqrt{Re}}{x} = 1.478$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.243	-0.156	0	0.276	-0.065	0	0
.1	.001	.024	.229	-.138	.027	.269	-.060	.024	.047
.2	.005	.046	.216	-.123	.054	.264	-.057	.048	.092
.3	.010	.067	.204	-.110	.080	.258	-.053	.072	.134
.4	.018	.087	.194	-.100	.105	.253	-.051	.096	.173
.5	.028	.106	.184	-.091	.130	.248	-.048	.119	.211
.6	.039	.124	.175	-.083	.155	.243	-.046	.143	.247
.7	.052	.141	.167	-.076	.179	.238	-.045	.166	.281
.8	.067	.157	.160	-.071	.203	.234	-.043	.189	.314
.9	.084	.173	.153	-.066	.226	.230	-.042	.212	.345
1.0	.102	.188	.147	-.062	.249	.226	-.041	.234	.375
1.2	.142	.216	.135	-.054	.293	.218	-.040	.279	.432
1.4	.188	.242	.125	-.049	.336	.210	-.039	.323	.484
1.6	.239	.266	.115	-.045	.377	.202	-.038	.366	.532
1.8	.294	.288	.107	-.041	.417	.194	-.038	.408	.576
2.0	.354	.309	.099	-.038	.455	.187	-.038	.449	.617
2.2	.417	.328	.091	-.036	.491	.179	-.037	.489	.655
2.4	.485	.345	.084	-.034	.527	.172	-.037	.527	.690
2.6	.555	.361	.078	-.032	.560	.164	-.037	.564	.723
2.8	.629	.376	.072	-.030	.592	.157	-.037	.599	.753
3.2	.785	.403	.060	-.027	.652	.142	-.037	.666	.806
3.6	.951	.425	.050	-.024	.706	.127	-.037	.725	.850
4.0	1.124	.443	.041	-.022	.754	.113	-.035	.777	.886
4.4	1.305	.458	.033	-.019	.797	.099	-.034	.822	.915
4.8	1.490	.469	.026	-.016	.834	.086	-.032	.860	.938
5.2	1.680	.478	.020	-.014	.865	.073	-.030	.892	.956
5.6	1.872	.485	.015	-.011	.893	.062	-.027	.918	.970
6.4	2.264	.494	.008	-.007	.934	.042	-.021	.954	.987
7.2	2.661	.498	.003	-.004	.962	.027	-.016	.976	.995
8.0	3.060	.499	.001	-.002	.979	.017	-.011	.988	.998
8.8	3.459	.500	.000	-.001	.989	.009	-.007	.994	.999
9.6	3.859				.994	.005	-.004	.996	
10.4	4.259				.997	.002	-.002	.998	
11.2	4.659				.998	.001	-.001	.998	
12.0	5.059				.999	.001	-.001	.999	
12.8	5.459				1.000	.000	.000	.999	
13.6	5.859				1.000	.000	.000	.999	
14.4	6.259				1.000	.000	.000	.999	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(8) $T_\infty/T_W = 2$; $Eu = 0$; $f_W = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 1.537$; $\frac{\delta_1\sqrt{Re}}{x} = 1.271$; $\frac{\delta_\alpha\sqrt{Re}}{x} = 1.495$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.312	-0.248	0	0.294	-0.074	0	0
.1	.002	.030	.289	-.218	.029	.287	-.068	.031	.060
.2	.006	.058	.269	-.193	.057	.281	-.064	.061	.116
.3	.013	.084	.250	-.172	.085	.274	-.060	.091	.168
.4	.023	.108	.234	-.154	.112	.269	-.057	.120	.216
.5	.035	.131	.220	-.139	.139	.263	-.055	.149	.262
.6	.049	.152	.206	-.127	.165	.258	-.052	.177	.304
.7	.065	.172	.194	-.116	.191	.252	-.051	.205	.344
.8	.083	.191	.183	-.106	.216	.247	-.049	.232	.382
.9	.103	.209	.173	-.098	.240	.243	-.048	.259	.418
1.0	.125	.226	.163	-.091	.264	.238	-.047	.285	.451
1.2	.173	.256	.146	-.079	.311	.229	-.046	.336	.513
1.4	.227	.284	.131	-.070	.356	.220	-.045	.385	.568
1.6	.287	.309	.118	-.062	.399	.211	-.044	.432	.618
1.8	.351	.332	.106	-.056	.440	.202	-.043	.477	.663
2.0	.419	.352	.096	-.050	.479	.193	-.044	.520	.704
2.2	.491	.370	.086	-.046	.517	.185	-.043	.561	.740
2.4	.567	.386	.078	-.042	.553	.176	-.043	.600	.773
2.6	.646	.401	.070	-.038	.588	.168	-.043	.637	.802
2.8	.728	.414	.062	-.035	.620	.159	-.043	.671	.829
3.2	.898	.436	.049	-.029	.681	.142	-.042	.734	.873
3.6	1.076	.454	.039	-.025	.734	.126	-.040	.787	.908
4.0	1.260	.468	.030	-.020	.781	.110	-.039	.833	.935
4.4	1.450	.478	.022	-.017	.822	.095	-.037	.871	.956
4.8	1.642	.486	.016	-.014	.857	.081	-.034	.902	.971
5.2	1.838	.491	.011	-.011	.887	.068	-.031	.926	.982
5.6	2.035	.495	.008	-.008	.912	.056	-.027	.946	.989
6.4	2.432	.498	.003	-.004	.949	.037	-.021	.971	.997
7.2	2.832	.500	.000	-.002	.972	.023	-.015	.986	.999
8.0	3.232	.500	.000	.000	.986	.013	-.009	.992	.999
8.8	3.632				.994	.007	-.006	.996	
9.6	4.032				.998	.004	-.003	.998	
10.4	4.432				1.000	.002	-.002	.999	
11.2	4.832				1.000	.001	-.001	1.000	
12.0	5.232				1.000	.000	.000	1.000	
12.8	5.632				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(9) $T_\infty/T_w = 2$; $Eu = 0.5$; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.699$; $\frac{\delta_1\sqrt{Re}}{x} = 0.899$; $\frac{\delta_c\sqrt{Re}}{x} = 1.370$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.679	-0.984	0	0.400	-0.136	0	0
.2	.012	.118	.514	-.700	.078	.376	-.114	.128	.237
.4	.046	.208	.394	-.515	.151	.355	-.101	.240	.417
.6	.094	.277	.303	-.388	.220	.335	-.093	.339	.556
.8	.155	.331	.235	-.296	.284	.316	-.088	.425	.662
1.0	.226	.372	.183	-.230	.346	.299	-.086	.501	.745
1.2	.304	.405	.142	-.180	.404	.282	-.084	.568	.809
1.4	.387	.430	.110	-.142	.459	.265	-.083	.627	.860
1.6	.475	.449	.084	-.112	.510	.249	-.082	.678	.898
1.8	.566	.464	.064	-.089	.558	.232	-.081	.723	.928
2.0	.660	.475	.048	-.071	.603	.216	-.080	.762	.950
2.2	.756	.484	.036	-.057	.645	.200	-.078	.795	.967
2.4	.854	.490	.026	-.044	.683	.185	-.076	.824	.979
2.6	.952	.494	.018	-.036	.719	.170	-.074	.849	.988
2.8	1.051	.497	.011	-.028	.752	.156	-.071	.870	.994
3.0	1.151	.498	.006	-.022	.781	.142	-.068	.888	.997
3.2	1.250	.499	.002	-.017	.808	.128	-.065	.903	.999
3.4	1.350	.500	.000	-.013	.833	.116	-.061	.916	.999
3.6	1.450				.855	.104	-.058	.927	
4.0	1.650				.892	.082	-.050	.946	
4.4	1.850				.921	.064	-.042	.961	
4.8	2.050				.944	.049	-.035	.972	
5.2	2.250				.960	.036	-.028	.980	
5.6	2.450				.973	.026	-.022	.986	
6.0	2.650				.982	.018	-.017	.991	
6.4	2.850				.988	.013	-.012	.994	
6.8	3.050				.992	.009	-.009	.996	
7.2	3.250				.995	.006	-.006	.997	
7.6	3.450				.997	.004	-.004	.998	
8.0	3.650				.998	.002	-.003	.999	
8.4	3.850				.999	.001	-.002	.999	
8.8	4.050				.999	.001	-.001	1.000	
9.2	4.250				.999	.001	-.001	1.000	
9.6	4.450				1.000	.000	-.001	1.000	
10.0	4.650				1.000	.000	.000	1.000	
10.4	4.850				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(10) $T_\infty/T_w = 2$; Eu = 1; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.515$; $\frac{\delta_1\sqrt{Re}}{x} = 0.763$; $\frac{\delta_c\sqrt{Re}}{x} = 1.215$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.899	-1.647	0	0.473	-0.190	0	0
.1	.004	.082	.750	-1.336	.046	.455	-.169	.086	.165
.2	.016	.151	.629	-1.098	.091	.438	-.154	.165	.302
.3	.034	.209	.529	-.910	.134	.424	-.144	.237	.418
.4	.058	.257	.446	-.760	.176	.410	-.136	.303	.515
.5	.085	.298	.376	-.637	.216	.396	-.130	.363	.597
.6	.117	.333	.318	-.537	.255	.383	-.126	.418	.666
.7	.152	.362	.268	-.455	.293	.371	-.124	.468	.724
.8	.189	.387	.226	-.386	.329	.359	-.122	.514	.774
.9	.229	.408	.190	-.328	.365	.347	-.120	.556	.815
1.0	.271	.425	.160	-.280	.399	.335	-.119	.595	.850
1.1	.314	.440	.134	-.239	.431	.323	-.118	.630	.880
1.2	.359	.452	.112	-.205	.463	.311	-.117	.662	.904
1.4	.451	.471	.077	-.150	.523	.288	-.115	.717	.942
1.6	.546	.484	.051	-.111	.578	.265	-.113	.763	.967
1.8	.644	.492	.032	-.082	.629	.243	-.110	.801	.983
2.0	.743	.497	.018	-.060	.675	.221	-.107	.832	.993
2.2	.843	.499	.007	-.044	.718	.200	-.102	.857	.998
2.4	.942	.500	.000	-.032	.756	.180	-.098	.877	1.000
2.6	1.042				.790	.161	-.092	.894	
2.8	1.142				.820	.143	-.087	.910	
3.0	1.242				.847	.126	-.081	.923	
3.2	1.342				.871	.111	-.074	.935	
3.4	1.442				.891	.096	-.068	.945	
3.6	1.542				.909	.083	-.062	.954	
3.8	1.642				.925	.072	-.056	.962	
4.0	1.742				.938	.061	-.050	.968	
4.4	1.942				.959	.043	-.039	.979	
4.8	2.142				.973	.030	-.029	.986	
5.2	2.342				.983	.020	-.021	.991	
5.6	2.542				.990	.013	-.015	.994	
6.0	2.742				.994	.008	-.010	.996	
6.4	2.942				.996	.005	-.006	.998	
6.8	3.142				.997	.003	-.004	.998	
7.2	3.342				.998	.002	-.002	.999	
7.6	3.542				.999	.001	-.001	.999	
8.0	3.742				.999	.000	-.001	.999	
8.4	3.942				.999	.000	.000	.999	
8.8	4.142				.999	.000	.000	.999	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(11) $T_\infty/T_W = 4$; Eu = -0.1351; $f_W = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 6.950$; $\frac{\delta_1\sqrt{Re}}{x} = 3.109$; $\frac{\delta_c\sqrt{Re}}{x} = 1.834$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0	0.034	0	0.179	-0.082	0	0
.2	.000	.001	.005	.022	.034	.165	-.063	.001	.002
.4	.000	.002	.009	.015	.066	.154	-.050	.002	.008
.6	.001	.004	.012	.011	.096	.145	-.041	.005	.017
.8	.002	.007	.014	.009	.124	.137	-.035	.009	.027
1.0	.004	.010	.015	.007	.151	.131	-.030	.014	.039
1.2	.006	.013	.016	.006	.177	.125	-.026	.020	.052
1.4	.009	.016	.018	.004	.201	.120	-.023	.026	.065
1.6	.012	.020	.018	.004	.225	.116	-.021	.033	.080
1.8	.017	.024	.019	.003	.248	.112	-.019	.041	.094
2.0	.022	.028	.020	.003	.270	.108	-.017	.050	.110
2.2	.028	.032	.020	.002	.291	.105	-.016	.059	.126
2.4	.034	.036	.020	.002	.311	.102	-.014	.069	.142
2.6	.042	.040	.021	.002	.331	.099	-.013	.079	.159
2.8	.050	.044	.021	.001	.351	.096	-.012	.090	.176
3.0	.060	.048	.022	.001	.370	.094	-.012	.102	.193
3.2	.070	.052	.022	.001	.389	.092	-.011	.114	.210
3.6	.092	.061	.022	.001	.424	.087	-.010	.139	.245
4.0	.119	.070	.022	.000	.459	.084	-.009	.167	.281
4.4	.148	.079	.022	.000	.491	.080	-.009	.196	.316
4.8	.182	.088	.022	.000	.523	.077	-.008	.226	.352
5.2	.219	.097	.022	.000	.553	.073	-.008	.258	.388
5.6	.260	.106	.022	.000	.582	.070	-.007	.291	.424
6.0	.304	.115	.022	-.001	.609	.067	-.007	.325	.459
6.4	.351	.124	.022	-.001	.636	.065	-.007	.359	.494
6.8	.402	.132	.021	-.001	.661	.062	-.007	.394	.528
7.2	.457	.140	.021	-.001	.685	.059	-.007	.429	.562
7.6	.515	.149	.020	-.001	.708	.056	-.007	.464	.595
8.0	.576	.157	.020	-.002	.730	.053	-.007	.500	.626
8.4	.640	.164	.019	-.002	.751	.051	-.007	.534	.657
8.8	.707	.172	.018	-.002	.771	.048	-.006	.568	.686
9.2	.777	.178	.017	-.002	.789	.046	-.006	.601	.714
9.6	.850	.185	.016	-.002	.807	.043	-.006	.634	.741
10.4	1.003	.198	.014	-.002	.840	.038	-.006	.695	.790
11.2	1.165	.208	.013	-.002	.868	.033	-.006	.751	.834
12.0	1.336	.218	.011	-.002	.893	.029	-.006	.801	.871
12.8	1.513	.226	.009	-.002	.914	.024	-.005	.845	.903
13.6	1.696	.232	.007	-.002	.932	.021	-.005	.881	.929
14.4	1.884	.237	.006	-.002	.947	.017	-.004	.912	.949
15.2	2.076	.241	.004	-.001	.959	.014	-.004	.936	.965
16.0	2.270	.244	.003	-.001	.969	.011	-.003	.955	.977
16.8	2.466	.246	.002	-.001	.977	.009	-.003	.969	.986
17.6	2.664	.248	.002	-.001	.984	.007	-.002	.980	.992
18.4	2.863	.249	.001	-.001	.988	.005	-.002	.987	.996
19.2	3.062	.250	.000	.000	.992	.004	-.001	.992	.998
20.0	3.262	.250	.000	.000	.995	.003	-.001	.996	1.000
20.8	3.462	.250	.000	.000	.997	.002	-.001	.998	1.000
21.6	3.662	.250	.000	.000	.998	.001	-.001	1.000	1.000
22.4	3.862	.250	.000	.000	.999	.001	.000	1.000	1.000
23.2	4.062				1.000	.001	.000	1.000	
24.0	4.262				1.000	.000	.000	1.000	
24.8	4.462				1.000	.000	.000	1.000	
25.6	4.662				1.000	.000	.000	1.000	
26.4	4.862				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(12) $T_\infty/T_w = 4$; $Eu = -0.09$; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 2.297$; $\frac{\delta_i\sqrt{Re}}{x} = 2.719$; $\frac{\delta_c\sqrt{Re}}{x} = 2.595$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.193	-0.391	0	0.264	-0.179	0	0
.1	.001	.018	.160	-.277	.026	.248	-.146	.019	.070
.2	.003	.032	.137	-.206	.050	.235	-.123	.037	.130
.3	.007	.045	.118	-.158	.073	.223	-.105	.055	.180
.4	.012	.056	.104	-.124	.094	.213	-.091	.072	.225
.5	.018	.066	.093	-.100	.115	.205	-.081	.089	.264
.6	.026	.075	.084	-.082	.136	.197	-.072	.106	.300
.7	.034	.083	.077	-.069	.155	.190	-.065	.122	.332
.8	.042	.090	.070	-.058	.174	.184	-.059	.138	.362
.9	.052	.097	.065	-.050	.192	.179	-.054	.153	.389
1.0	.062	.104	.060	-.043	.210	.173	-.050	.169	.414
1.1	.072	.109	.056	-.037	.227	.169	-.046	.184	.437
1.2	.083	.115	.053	-.033	.243	.164	-.043	.199	.459
1.4	.107	.125	.047	-.026	.275	.156	-.038	.228	.499
1.6	.133	.134	.042	-.021	.306	.149	-.034	.256	.535
1.8	.161	.142	.038	-.018	.335	.143	-.030	.284	.567
2.0	.190	.149	.035	-.015	.363	.137	-.028	.312	.597
2.2	.220	.156	.032	-.013	.390	.131	-.026	.338	.624
2.4	.252	.162	.030	-.011	.416	.126	-.024	.365	.649
2.6	.285	.168	.028	-.010	.441	.122	-.023	.390	.672
2.8	.320	.174	.026	-.009	.465	.117	-.022	.415	.694
3.2	.391	.183	.023	-.007	.510	.109	-.019	.464	.733
3.6	.466	.192	.020	-.006	.552	.102	-.018	.510	.768
4.0	.544	.200	.018	-.005	.591	.095	-.017	.553	.798
4.4	.626	.206	.016	-.005	.628	.088	-.016	.595	.825
4.8	.709	.212	.014	-.004	.662	.082	-.015	.634	.849
5.2	.795	.218	.012	-.004	.694	.076	-.014	.670	.870
5.6	.883	.222	.011	-.003	.723	.071	-.013	.705	.889
6.0	.973	.226	.010	-.003	.750	.066	-.013	.736	.906
6.4	1.064	.230	.009	-.003	.776	.061	-.012	.766	.921
6.8	1.157	.233	.008	-.003	.799	.056	-.012	.793	.934
7.2	1.251	.236	.006	-.002	.820	.051	-.011	.818	.945
7.6	1.346	.239	.006	-.002	.840	.047	-.010	.840	.954
8.0	1.442	.241	.005	-.002	.858	.043	-.010	.860	.963
8.8	1.636	.244	.003	-.002	.889	.035	-.009	.895	.976
9.6	1.832	.246	.002	-.001	.915	.029	-.008	.922	.985
10.4	2.030	.248	.001	-.001	.936	.023	-.007	.943	.991
11.2	2.228	.249	.001	.000	.952	.018	-.006	.959	.995
12.0	2.427	.249	.000	.000	.965	.014	-.005	.971	.997
12.8	2.627	.249	.000	.000	.975	.010	-.004	.979	.998
13.6	2.826	.250	.000	.000	.982	.008	-.003	.985	.998
14.4	3.026	.250	.000	.000	.988	.006	-.002	.989	.998
15.2	3.226				.992	.004	-.002	.992	
16.0	3.426				.994	.003	-.001	.994	
16.8	3.626				.996	.002	-.001	.995	
17.6	3.826				.998	.001	-.001	.996	
18.4	4.026				.999	.001	-.001	.997	
19.2	4.226				.999	.001	.000	.998	
20.0	4.426				1.000	.000	.000	.998	
20.8	4.626				1.000	.000	.000	.998	
21.6	4.826				1.000	.000	.000	.998	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(13) $T_\infty/T_w = 4$; $Eu = -0.05$; $f_w = 0$

$\frac{\delta^* \sqrt{Re}}{x} = 1.810$; $\frac{\delta_1 \sqrt{Re}}{x} = 2.582$; $\frac{\delta_c \sqrt{Re}}{x} = 2.651$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.240	-0.529	0	0.279	-0.199	0	0
.1	.001	.022	.196	-.365	.027	.261	-.160	.024	.087
.2	.004	.040	.164	-.271	.052	.247	-.134	.046	.158
.3	.009	.055	.140	-.205	.076	.234	-.114	.067	.219
.4	.015	.068	.122	-.161	.099	.224	-.099	.088	.272
.5	.022	.079	.108	-.129	.121	.214	-.087	.108	.318
.6	.031	.090	.096	-.105	.142	.206	-.077	.128	.358
.7	.040	.099	.087	-.087	.162	.199	-.070	.147	.395
.8	.050	.107	.079	-.073	.182	.192	-.063	.165	.428
.9	.062	.114	.072	-.062	.201	.186	-.058	.184	.458
1.0	.073	.121	.066	-.054	.219	.180	-.053	.201	.486
1.1	.086	.128	.061	-.046	.237	.175	-.049	.219	.511
1.2	.099	.134	.057	-.041	.254	.170	-.046	.236	.535
1.4	.127	.144	.050	-.032	.287	.162	-.041	.269	.577
1.6	.157	.154	.044	-.026	.319	.154	-.036	.301	.614
1.8	.188	.162	.039	-.022	.349	.147	-.033	.332	.648
2.0	.221	.169	.035	-.018	.378	.141	-.030	.361	.677
2.2	.256	.176	.032	-.015	.406	.135	-.028	.390	.704
2.4	.292	.182	.029	-.013	.432	.130	-.026	.418	.728
2.6	.329	.188	.026	-.012	.458	.125	-.024	.445	.750
2.8	.367	.193	.024	-.010	.482	.120	-.023	.471	.771
3.2	.446	.202	.021	-.008	.528	.111	-.021	.521	.806
3.6	.528	.209	.018	-.007	.571	.103	-.019	.568	.837
4.0	.613	.216	.015	-.006	.611	.096	-.018	.611	.863
4.4	.700	.221	.013	-.005	.648	.089	-.017	.652	.886
4.8	.790	.226	.011	-.004	.682	.082	-.016	.689	.905
5.2	.881	.230	.010	-.004	.713	.076	-.015	.723	.921
5.6	.974	.234	.008	-.003	.743	.070	-.014	.755	.935
6.0	1.068	.237	.007	-.003	.769	.064	-.014	.783	.947
6.4	1.163	.239	.006	-.003	.794	.059	-.013	.810	.958
6.8	1.259	.242	.005	-.002	.817	.054	-.012	.833	.966
7.2	1.356	.243	.004	-.002	.838	.049	-.011	.855	.974
7.6	1.454	.245	.003	-.002	.857	.045	-.011	.874	.980
8.0	1.552	.246	.003	-.001	.874	.041	-.010	.891	.984
8.8	1.750	.248	.002	-.001	.903	.033	-.009	.920	.992
9.6	1.949	.249	.001	-.001	.927	.026	-.008	.941	.996
10.4	2.148	.249	.000	.000	.946	.021	-.006	.957	.998
11.2	2.348	.250	.000	.000	.961	.016	-.005	.969	.998
12.0	2.548				.972	.012	-.004	.977	
12.8	2.748				.980	.009	-.003	.984	
13.6	2.948				.986	.006	-.003	.988	
14.4	3.148				.991	.005	-.002	.991	
15.2	3.348				.994	.003	-.002	.994	
16.0	3.548				.996	.002	-.001	.995	
16.8	3.748				.997	.001	-.001	.996	
17.6	3.948				.998	.001	-.001	.997	
18.4	4.148				.999	.001	.000	.998	
19.2	4.348				.999	.000	.000	.998	
20.0	4.548				1.000	.000	.000	.998	
20.8	4.748				1.000	.000	.000	.998	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(14) $T_\infty/T_w = 4$; Eu = 0; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 1.428$; $\frac{\delta_1\sqrt{Re}}{x} = 2.457$; $\frac{\delta_c\sqrt{Re}}{x} = 2.663$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.287	-0.687	0	0.295	-0.222	0	0
.1	.001	.026	.230	-.471	.028	.275	-.179	.028	.103
.2	.005	.047	.191	-.340	.055	.259	-.147	.054	.186
.3	.011	.064	.161	-.256	.080	.245	-.125	.080	.256
.4	.018	.079	.138	-.198	.104	.234	-.108	.104	.316
.5	.026	.092	.120	-.156	.127	.224	-.094	.127	.368
.6	.036	.103	.106	-.127	.149	.215	-.084	.149	.413
.7	.047	.113	.095	-.104	.170	.207	-.075	.171	.453
.8	.059	.122	.085	-.087	.191	.200	-.068	.192	.489
.9	.071	.130	.077	-.074	.210	.193	-.062	.213	.522
1.0	.085	.138	.070	-.063	.229	.187	-.057	.233	.551
1.1	.099	.144	.064	-.055	.248	.182	-.052	.252	.578
1.2	.114	.151	.059	-.048	.266	.177	-.049	.271	.603
1.3	.129	.156	.055	-.042	.283	.172	-.046	.289	.626
1.4	.145	.162	.051	-.037	.300	.167	-.043	.307	.647
1.6	.178	.171	.044	-.030	.333	.159	-.038	.342	.685
1.8	.213	.180	.039	-.025	.364	.152	-.035	.375	.718
2.0	.250	.187	.034	-.021	.393	.145	-.032	.407	.747
2.2	.288	.193	.030	-.018	.422	.139	-.030	.438	.773
2.4	.327	.199	.027	-.015	.449	.133	-.028	.467	.796
2.6	.368	.204	.024	-.013	.475	.128	-.026	.495	.817
2.8	.409	.209	.022	-.011	.500	.122	-.025	.522	.835
3.2	.494	.217	.018	-.009	.547	.113	-.023	.573	.867
3.6	.582	.223	.015	-.007	.591	.104	-.021	.619	.889
4.0	.672	.229	.012	-.006	.631	.096	-.019	.662	.915
4.4	.765	.233	.010	-.005	.668	.089	-.018	.700	.932
4.8	.859	.237	.008	-.004	.702	.082	-.017	.735	.947
5.2	.954	.240	.007	-.004	.733	.075	-.016	.767	.959
5.6	1.050	.242	.005	-.003	.762	.069	-.015	.796	.968
6.0	1.148	.244	.004	-.002	.788	.063	-.014	.821	.976
6.4	1.246	.246	.003	-.002	.812	.057	-.013	.844	.983
6.8	1.344	.247	.003	-.002	.834	.052	-.013	.865	.988
7.2	1.443	.248	.002	-.002	.854	.047	-.012	.883	.991
8.0	1.642	.249	.001	-.001	.888	.038	-.010	.912	.996
8.8	1.841	.249	.000	-.001	.915	.030	-.009	.934	.998
9.6	2.040	.249	.000	.000	.937	.024	-.007	.950	.998
10.4	2.240				.954	.019	-.006	.963	
11.2	2.440				.967	.014	-.005	.973	
12.0	2.640				.977	.011	-.004	.980	
12.8	2.840				.985	.008	-.003	.986	
13.6	3.040				.990	.006	-.002	.990	
14.4	3.240				.994	.004	-.002	.993	
15.2	3.440				.996	.003	-.001	.995	
16.0	3.640				.998	.002	-.001	.996	
16.8	3.840				.999	.001	-.001	.997	
17.6	4.040				1.000	.001	.000	.998	
18.4	4.240				1.000	.000	.000	.998	
19.2	4.440				1.000	.000	.000	.998	
20.0	4.640				1.000	.000	.000	.998	
20.8	4.840				1.000	.000	.000	.998	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(15) $T_\infty/T_W = 4$; $Eu = 0.5$; $f_W = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.588$; $\frac{\delta_1\sqrt{Re}}{x} = 1.887$; $\frac{\delta_c\sqrt{Re}}{x} = 2.344$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.537	-1.810	0	0.388	-0.384	0	0
.1	.002	.046	.394	-1.117	.037	.354	-.289	.051	.184
.2	.009	.080	.302	-.748	.071	.329	-.228	.098	.323
.3	.018	.108	.239	-.529	.103	.308	-.187	.141	.432
.4	.030	.129	.194	-.387	.133	.291	-.157	.180	.516
.5	.044	.147	.160	-.295	.161	.276	-.136	.218	.586
.6	.059	.161	.134	-.230	.188	.263	-.119	.252	.645
.7	.076	.174	.113	-.184	.214	.252	-.106	.285	.694
.8	.094	.184	.097	-.150	.239	.242	-.096	.316	.736
.9	.113	.193	.083	-.123	.263	.233	-.087	.345	.772
1.0	.133	.201	.072	-.103	.286	.225	-.080	.373	.803
1.1	.153	.208	.062	-.087	.308	.217	-.074	.399	.830
1.2	.174	.213	.054	-.074	.329	.210	-.069	.424	.853
1.3	.196	.218	.047	-.064	.350	.203	-.064	.448	.874
1.4	.218	.223	.042	-.055	.370	.197	-.061	.470	.891
1.6	.263	.230	.032	-.042	.408	.185	-.055	.512	.920
1.8	.310	.236	.024	-.032	.444	.175	-.049	.550	.943
2.0	.357	.240	.019	-.026	.478	.166	-.046	.584	.960
2.2	.406	.243	.014	-.020	.510	.157	-.043	.616	.973
2.4	.454	.246	.010	-.016	.541	.149	-.040	.644	.983
2.6	.504	.248	.007	-.014	.570	.141	-.038	.670	.990
2.8	.553	.249	.005	-.011	.597	.133	-.036	.694	.995
3.0	.603	.250	.003	-.009	.623	.126	-.034	.716	.998
3.2	.653	.250	.001	-.007	.648	.120	-.033	.735	1.000
3.4	.703	.250	.000	-.006	.671	.113	-.031	.753	1.000
3.6	.753				.693	.107	-.030	.770	
4.0	.853				.734	.096	-.027	.800	
4.4	.953				.770	.086	-.025	.828	
4.8	1.053				.803	.076	-.023	.852	
5.2	1.153				.831	.067	-.021	.873	
5.6	1.253				.856	.059	-.019	.892	
6.0	1.353				.879	.052	-.018	.909	
6.4	1.453				.898	.045	-.016	.924	
6.8	1.553				.915	.039	-.014	.936	
7.2	1.653				.929	.033	-.013	.947	
7.6	1.753				.942	.029	-.011	.956	
8.0	1.853				.952	.024	-.010	.964	
8.4	1.953				.961	.021	-.009	.971	
8.8	2.053				.969	.017	-.008	.977	
9.6	2.253				.980	.012	-.006	.985	
10.4	2.453				.988	.008	-.004	.991	
11.2	2.653				.993	.005	-.003	.995	
12.0	2.853				.997	.003	-.002	.998	
12.8	3.053				.999	.002	-.001	.999	
13.6	3.253				1.000	.001	-.001	1.000	
14.4	3.453				1.000	.001	.000	1.000	
15.2	3.653				1.000	.000	.000	1.000	
16.0	3.853				1.000	.000	.000	1.000	
16.8	4.053				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(16) $T_\infty/T_w = 4$; Eu = 1.0; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.427$; $\frac{\delta_1\sqrt{Re}}{x} = 1.615$; $\frac{\delta_c\sqrt{Re}}{x} = 2.075$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.685	-2.764	0	0.453	-0.523	0	0
.05	.001	.031	.566	-2.062	.022	.429	-.440	.033	.124
.10	.003	.057	.476	-1.586	.043	.409	-.378	.064	.228
.15	.006	.079	.405	-1.251	.063	.391	-.329	.094	.316
.20	.011	.098	.349	-1.007	.082	.376	-.291	.122	.391
.25	.016	.114	.303	-.824	.101	.362	-.260	.148	.456
.30	.022	.128	.266	-.684	.118	.349	-.234	.174	.514
.35	.029	.141	.234	-.575	.136	.338	-.213	.207	.564
.40	.036	.152	.208	-.490	.152	.328	-.195	.221	.608
.45	.044	.162	.185	-.420	.168	.319	-.179	.243	.647
.50	.052	.170	.166	-.363	.184	.310	-.166	.265	.682
.55	.061	.178	.149	-.316	.200	.302	-.155	.285	.713
.60	.070	.185	.134	-.277	.215	.295	-.145	.305	.742
.65	.080	.192	.121	-.245	.229	.288	-.137	.324	.767
.70	.089	.198	.109	-.217	.243	.281	-.128	.342	.790
.75	.099	.203	.099	-.193	.257	.275	-.122	.359	.811
.80	.110	.208	.090	-.173	.271	.269	-.116	.376	.830
.85	.120	.212	.082	-.155	.284	.263	-.110	.392	.847
.90	.131	.216	.074	-.140	.297	.258	-.105	.408	.863
.95	.142	.219	.068	-.126	.310	.253	-.101	.423	.877
1.00	.153	.222	.062	-.115	.323	.248	-.096	.438	.890
1.10	.175	.228	.051	-.095	.347	.238	-.089	.466	.912
1.20	.198	.233	.043	-.079	.371	.230	-.083	.492	.931
1.30	.222	.237	.035	-.067	.393	.222	-.078	.516	.947
1.40	.246	.240	.029	-.057	.415	.214	-.074	.539	.960
1.50	.270	.243	.024	-.049	.436	.207	-.070	.560	.970
1.60	.294	.245	.019	-.042	.456	.200	-.066	.580	.979
1.70	.319	.246	.016	-.036	.476	.194	-.063	.599	.986
1.80	.343	.248	.012	-.031	.495	.187	-.061	.616	.992
2.00	.393	.250	.007	-.024	.531	.176	-.056	.648	.999
2.20	.443	.250	.002	-.018	.565	.165	-.052	.676	1.000
2.40	.493	.250	-.001	-.014	.597	.155	-.049	.700	1.000
2.60	.543				.627	.145	-.046	.723	
2.80	.593				.656	.136	-.044	.744	
3.00	.643				.682	.128	-.041	.764	
3.20	.693				.707	.120	-.039	.782	
3.40	.743				.730	.112	-.037	.800	
3.60	.793				.752	.105	-.035	.816	
3.80	.843				.772	.098	-.034	.832	
4.00	.893				.791	.092	-.032	.846	
4.40	.993				.825	.079	-.029	.872	
4.80	1.093				.855	.068	-.026	.894	
5.20	1.193				.880	.059	-.023	.913	
5.60	1.293				.902	.050	-.021	.930	
6.00	1.393				.920	.042	-.018	.943	
6.40	1.493				.936	.035	-.016	.955	
6.80	1.593				.949	.029	-.014	.965	
7.20	1.693				.959	.024	-.012	.973	
7.60	1.793				.968	.020	-.010	.979	
8.00	1.893				.975	.016	-.009	.985	
8.40	1.993				.981	.013	-.007	.989	
8.80	2.093				.985	.010	-.006	.992	
9.60	2.293				.992	.006	-.004	.997	
10.40	2.493				.996	.004	-.002	.999	
11.20	2.693				.998	.002	-.002	1.000	
12.00	2.893				.999	.001	-.001	1.000	
12.80	3.093				1.000	.001	.000	1.000	
13.60	3.293				1.000	.000	.000	1.000	
14.40	3.493				1.000	.000	.000	1.000	
15.20	3.693				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(17) $T_\infty/T_w = 1$; $Eu = -0.0418$; $f_w = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 4.272$; $\frac{\delta_i\sqrt{Re}}{x} = 0.954$; $\frac{\delta_c\sqrt{Re}}{x} = 0.807$

η	f	f'	f''	f'''	θ	θ'	θ''
0	-0.500	0	0	0.042	0	0.103	0.017
.4	-.500	.003	.018	.046	.043	.110	.018
.8	-.496	.142	.037	.051	.088	.118	.020
1.2	-.487	.033	.058	.055	.137	.126	.020
1.6	-.469	.061	.081	.060	.189	.134	.021
2.0	-.437	.098	.106	.064	.244	.142	.021
2.4	-.389	.146	.132	.065	.303	.151	.020
2.8	-.319	.204	.158	.064	.364	.158	.017
3.2	-.225	.272	.182	.058	.429	.164	.012
3.6	-.101	.349	.204	.047	.495	.168	.006
4.0	.055	.434	.219	.028	.562	.168	-.003
4.4	.246	.523	.225	.004	.629	.165	-.014
4.8	.474	.613	.221	-.024	.694	.157	-.025
5.2	.736	.699	.206	-.051	.754	.145	-.036
5.6	1.032	.776	.181	-.073	.809	.129	-.045
6.0	1.356	.843	.149	-.085	.857	.110	-.050
6.4	1.704	.896	.115	-.085	.897	.089	-.051
6.8	2.070	.935	.082	-.076	.928	.069	-.048
7.2	2.450	.962	.055	-.061	.952	.051	-.042
7.6	2.838	.979	.034	-.044	.970	.036	-.034
8.0	3.232	.990	.019	-.029	.982	.024	-.026
8.4	3.630	.995	.010	-.017	.989	.015	-.018
8.8	4.028	.998	.005	-.010	.994	.009	-.012
9.2	4.428	1.000	.002	-.005	.997	.005	-.008
9.6	4.828	1.000	.001	-.002	.998	.003	-.004
10.0	5.228	1.000	.000	-.001	.999	.001	-.002
10.4	5.628	1.000	.000	.000	1.000	.001	-.001
10.8	6.028	1.000	.000	.000	1.000	.000	-.001
11.2	4.428				1.000	.000	.000
11.6	6.828				1.000	.000	.000
12.0	7.228				1.000	.000	.000
12.4	7.628				1.000	.000	.000
12.8	8.028				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(18) $T_\infty/T_w = 1$; $Eu = 0$; $f_w = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 2.459$; $\frac{\delta_i\sqrt{Re}}{x} = 0.827$; $\frac{\delta_c\sqrt{Re}}{x} = 0.973$

η	f	f'	f''	f'''	θ	θ'	θ''
0	-0.500	0	0.165	0.041	0	0.166	0.029
.4	-.486	.070	.182	.044	.069	.178	.030
.8	-.444	.146	.200	.044	.142	.190	.030
1.2	-.369	.228	.217	.040	.221	.201	.026
1.6	-.260	.318	.231	.030	.303	.210	.019
2.0	-.114	.412	.240	.014	.389	.216	.009
2.4	.070	.509	.241	-.008	.476	.217	-.005
2.8	.293	.604	.232	-.034	.562	.212	-.022
3.2	.553	.694	.214	-.059	.644	.200	-.039
3.6	.847	.774	.186	-.079	.720	.181	-.054
4.0	1.170	.841	.152	-.089	.788	.157	-.064
4.4	1.518	.895	.116	-.088	.846	.130	-.069
4.8	1.884	.933	.083	-.078	.892	.103	-.068
5.2	2.264	.962	.055	-.062	.928	.077	-.061
5.6	2.652	.980	.034	-.044	.954	.054	-.050
6.0	3.046	.990	.019	-.029	.972	.036	-.039
6.4	3.443	.995	.010	-.017	.984	.023	-.028
6.8	3.842	.998	.005	-.009	.991	.014	-.019
7.2	4.242	1.000	.002	-.004	.995	.008	-.012
7.6	4.641	1.000	.001	-.002	.998	.004	-.007
8.0	5.041	1.000	.000	-.001	.999	.002	-.004
8.4	5.441				1.000	.001	-.002
8.8	5.841				1.000	.000	-.001
9.2	6.241				1.000	.000	.000
9.6	6.641				1.000	.000	.000
10.0	7.041				1.000	.000	.000
10.4	7.441				1.000	.000	.000
10.8	7.841				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(19) $T_\infty/T_W = 1$; Eu = 0.5; $f_W = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 1.033$; $\frac{\delta_i\sqrt{Re}}{x} = 0.444$; $\frac{\delta_c\sqrt{Re}}{x} = 0.994$

η	f	f'	f''	f'''	θ	θ'	θ''
0	-0.500	0	0.697	-0.238	0	0.259	0.068
.2	-.486	.135	.648	-.254	.053	.273	.070
.4	-.447	.259	.596	-.267	.109	.287	.067
.6	-.384	.373	.542	-.275	.168	.300	.060
.8	-.298	.476	.486	-.278	.229	.311	.049
1.0	-.194	.567	.431	-.276	.292	.319	.032
1.2	-.072	.648	.376	-,270	.356	.324	.012
1.4	.065	.718	.323	-.258	.421	.324	-.011
1.6	.215	.778	.273	-.242	.486	.319	-.036
1.8	.375	.827	.227	-.222	.548	.309	-.061
2.0	.545	.868	.185	-.198	.609	.295	-.084
2.2	.722	.902	.148	-.173	.666	.276	-.105
2.4	.905	.928	.116	-.148	.719	.253	-.120
2.6	1.093	.948	.088	-.123	.767	.228	-.131
2.8	1.284	.964	.066	-.100	.810	.201	-.136
3.0	1.478	.975	.048	-.078	.848	.174	-.135
3.2	1.674	.983	.035	-.060	.880	.148	-.130
3.4	1.871	.989	.024	-.045	.907	.122	-.120
3.6	2.070	.993	.016	-.033	.929	.100	-.108
3.8	2.268	.996	.011	-.023	.947	.079	-.094
4.0	2.468	.998	.007	-.016	.961	.062	-.080
4.2	2.667	.999	.004	-.010	.972	.047	-.066
4.4	2.867	.999	.003	-.007	.980	.035	-.053
4.6	3.067	1.000	.002	-.004	.986	.026	-.042
4.8	3.267	1.000	.001	-.002	.990	.018	-.032
5.0	3.467	1.000	.001	-.002	.994	.013	-.024
5.2	3.667	1.000	.000	-.001	.996	.009	-.017
5.4	3.867	1.000	.000	.000	.997	.006	-.012
5.6	4.067	1.000	.000	.000	.998	.004	-.009
5.8	4.267	1.000	.000	.000	.999	.003	-.006
6.0	4.467				.999	.002	-.004
6.2	4.667				1.000	.001	-.002
6.4	4.867				1.000	.001	-.002
6.6	5.067				1.000	.000	-.001
6.8	5.267				1.000	.000	-.001
7.0	5.467				1.000	.000	.000
7.2	5.667				1.000	.000	.000
7.4	5.867				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(20) $T_\infty/T_w = 1$; Eu = 1; $f_w = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 0.783$; $\frac{\delta_i\sqrt{Re}}{x} = 0.345$; $\frac{\delta_c\sqrt{Re}}{x} = 0.918$

η	f	f'	f''	f'''	θ	θ'	θ''
0	-0.500	0	0.969	-0.516	0	0.293	0.103
.2	-.481	.183	.862	-.551	.061	.314	.106
.4	-.428	.344	.750	-.560	.126	.335	.100
.6	-.345	.483	.640	-.545	.194	.354	.085
.8	-.236	.601	.534	-.513	.267	.368	.061
1.0	-.106	.697	.435	-.468	.341	.377	.028
1.2	.042	.775	.347	-.413	.418	.383	-.011
1.4	.203	.837	.270	-.355	.493	.373	-.053
1.6	.375	.884	.205	-.295	.566	.358	-.094
1.8	.556	.920	.152	-.239	.636	.335	-.130
2.0	.742	.946	.109	-.187	.700	.306	-.159
2.2	.933	.964	.076	-.142	.758	.272	-.178
2.4	1.128	.977	.052	-.105	.809	.236	-.186
2.6	1.324	.985	.034	-.075	.852	.199	-.184
2.8	1.521	.991	.022	-.052	.888	.163	-.173
3.0	1.720	.994	.013	-.034	.918	.130	-.156
3.2	1.919	.996	.008	-.023	.941	.101	-.135
3.4	2.118	.997	.004	-.014	.958	.076	-.112
3.6	2.318	.998	.002	-.009	.971	.056	-.090
3.8	2.517	.998	.000	-.005	.981	.040	-.070
4.0	2.717	.998	.000	-.003	.987	.028	-.052
4.2	2.917				.992	.018	-.038
4.4	3.117				.995	.012	-.026
4.6	3.317				.997	.008	-.018
4.8	3.517				.998	.005	-.012
5.0	3.717				.999	.003	-.008
5.2	3.917				.999	.002	-.005
5.4	4.117				1.000	.001	-.003
5.6	4.317				1.000	.000	-.002
5.8	4.517				1.000	.000	-.001
6.0	4.717				1.000	.000	.000
6.2	4.917				1.000	.000	.000
6.4	5.117				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(21) $T_\infty/T_w = 2$; Eu = 0; $f_w = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 2.381$; $\frac{\delta_1\sqrt{Re}}{x} = 1.605$; $\frac{\delta_c\sqrt{Re}}{x} = 1.778$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-0.500	0	0.148	-0.027	0	0.160	0.006	0	0
.2	-.497	.029	.142	-.025	.032	.161	.006	.030	.058
.4	-.488	.057	.138	-.024	.065	.163	.006	.061	.114
.6	-.474	.084	.133	-.023	.097	.164	.005	.092	.168
.8	-.455	.110	.128	-.022	.130	.165	.004	.124	.220
1.0	-.430	.135	.124	-.022	.163	.165	.003	.157	.271
1.2	-.401	.160	.119	-.022	.196	.166	.001	.191	.319
1.4	-.367	.183	.115	-.022	.229	.166	.000	.225	.366
1.6	-.328	.206	.111	-.022	.262	.165	-.002	.260	.411
1.8	-.284	.227	.106	-.022	.295	.165	-.004	.294	.455
2.0	-.237	.248	.102	-.022	.328	.164	-.006	.330	.496
2.4	-.130	.287	.093	-.023	.393	.161	-.010	.400	.574
2.8	-.008	.322	.083	-.023	.457	.156	-.014	.469	.644
3.2	.128	.354	.074	-.023	.518	.150	-.018	.537	.707
3.6	.275	.382	.065	-.023	.576	.142	-.021	.601	.763
4.0	.432	.406	.056	-.022	.631	.133	-.024	.662	.811
4.4	.599	.426	.047	-.021	.682	.123	-.026	.717	.853
4.8	.773	.444	.039	-.017	.729	.112	-.027	.767	.887
5.2	.953	.458	.032	-.017	.772	.101	-.028	.811	.916
5.6	1.139	.469	.026	-.015	.810	.090	-.028	.850	.939
6.0	1.329	.478	.020	-.013	.844	.079	-.027	.882	.957
6.4	1.521	.485	.015	-.011	.873	.068	-.026	.909	.970
6.8	1.717	.490	.011	-.009	.899	.058	-.024	.931	.981
7.2	1.914	.494	.008	-.007	.920	.049	-.022	.948	.988
8.0	2.310	.498	.003	-.004	.952	.033	-.018	.972	.996
8.8	2.710	.500	.001	-.002	.974	.021	-.013	.986	.999
9.6	3.109	.500	.000	-.001	.986	.012	-.009	.993	1.000
10.4	3.509				.994	.006	-.005	.996	
11.2	3.909				.997	.003	-.003	.998	
12.0	4.309				.999	.001	-.001	.999	
12.8	4.709				1.000	.000	-.001	.999	
13.6	5.109				1.000	.000	.000	1.000	
14.4	5.509				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(22) $T_\infty/T_w = 2$; Eu = 0.5; $f_w = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 0.877$; $\frac{\delta_1\sqrt{Re}}{x} = 1.117$; $\frac{\delta_c\sqrt{Re}}{x} = 1.760$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-0.500	0	0.473	-0.365	0	0.229	0.016	0	0
.2	-.491	.088	.404	-.323	.046	.232	.014	.092	.176
.4	-.466	.162	.344	-.284	.093	.235	.011	.178	.325
.6	-.427	.226	.291	-.249	.140	.236	.007	.257	.452
.8	-.376	.279	.244	-.217	.187	.237	.001	.331	.558
1.0	-.316	.324	.204	-.188	.234	.237	-.004	.400	.648
1.2	-.248	.361	.169	-.162	.282	.235	-.011	.463	.722
1.4	-.172	.392	.139	-.138	.328	.233	-.017	.520	.783
1.6	-.091	.417	.113	-.118	.375	.229	-.024	.573	.834
1.8	-.006	.437	.092	-.100	.420	.223	-.029	.621	.874
2.0	.083	.454	.073	-.084	.464	.217	-.035	.664	.907
2.2	.176	.467	.058	-.071	.506	.210	-.040	.703	.933
2.4	.270	.477	.045	-.059	.547	.201	-.044	.738	.954
2.6	.366	.485	.034	-.049	.587	.192	-.047	.769	.969
2.8	.464	.491	.025	-.041	.624	.183	-.050	.797	.981
3.0	.562	.495	.018	-.033	.660	.172	-.052	.821	.990
3.2	.662	.498	.012	-.027	.693	.162	-.053	.843	.995
3.4	.761	.500	.007	-.022	.725	.151	-.053	.861	.999
3.6	.861	.500	.003	-.018	.754	.141	-.053	.878	1.000
3.8	.961	.501	-.001	-.014	.781	.130	-.053	.892	1.000
4.0	1.061				.806	.120	-.052	.904	
4.4	1.261				.850	.100	-.048	.926	
4.8	1.461				.886	.081	-.044	.944	
5.2	1.661				.915	.065	-.038	.959	
5.6	1.861				.938	.050	-.033	.970	
6.0	2.061				.956	.038	-.027	.979	
6.4	2.261				.969	.028	-.022	.986	
6.8	2.461				.979	.021	-.017	.990	
7.2	2.661				.986	.015	-.013	.994	
7.6	2.861				.991	.010	-.010	.996	
8.0	3.061				.993	.007	-.007	.998	
8.4	3.261				.996	.004	-.005	.999	
8.8	3.461				.997	.003	-.003	1.000	
9.2	3.661				.998	.002	-.002	1.000	
9.6	3.861				.999	.001	-.001	1.000	
10.0	4.061				.999	.001	-.001	1.000	
10.4	4.261				.999	.000	-.001	1.000	
10.8	4.461				1.000	.000	.000	1.000	
11.2	4.661				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(23) $T_\infty/T_W = 2$; $Eu = 1.0$; $f_W = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 0.637$; $\frac{\delta_1\sqrt{Re}}{x} = 0.968$; $\frac{\delta_c\sqrt{Re}}{x} = 1.613$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-0.500	0	0.634	-0.615	0	0.253	0.034	0	0
.2	-.488	.115	.519	-.542	.051	.259	.031	.121	.231
.4	-.456	.208	.418	-.467	.104	.265	.025	.230	.417
.6	-.406	.283	.332	-.395	.157	.269	.016	.328	.567
.8	-.344	.342	.259	-.328	.211	.271	.006	.414	.684
1.0	-.270	.388	.200	-.269	.265	.271	-.005	.491	.776
1.2	-.189	.423	.151	-.218	.319	.269	-.017	.558	.845
1.4	-.102	.449	.112	-.175	.373	.265	-.028	.616	.898
1.6	-.010	.468	.081	-.139	.425	.258	-.038	.667	.936
1.8	.085	.482	.056	-.110	.476	.249	-.047	.711	.963
2.0	.182	.491	.036	-.086	.525	.239	-.055	.748	.982
2.2	.281	.497	.021	-.068	.572	.228	-.061	.780	.993
2.4	.381	.500	.009	-.053	.616	.215	-.066	.807	.999
2.6	.481	.500	.000	-.041	.657	.201	-.069	.830	1.000
2.8	.581				.696	.187	-.071	.849	
3.0	.681				.732	.173	-.072	.867	
3.2	.781				.765	.158	-.071	.884	
3.6	.981				.823	.130	-.068	.912	
4.0	1.181				.870	.104	-.062	.936	
4.4	1.381				.907	.081	-.054	.954	
4.8	1.581				.935	.061	-.045	.968	
5.2	1.781				.956	.045	-.037	.979	
5.6	1.981				.971	.032	-.029	.987	
6.0	2.181				.982	.022	-.021	.992	
6.4	2.381				.989	.015	-.015	.996	
6.8	2.581				.994	.009	-.011	.998	
7.2	2.781				.997	.006	-.007	1.000	
7.6	2.981				.999	.003	-.004	1.000	
8.0	3.181				1.000	.002	-.003	1.000	
8.4	3.381				1.000	.001	-.001	1.000	
8.8	3.581				1.000	.001	-.001	1.000	
9.2	3.781				1.000	.000	-.001	1.000	
9.6	3.981				1.000	.000	.000	1.000	
10.0	4.181				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(24) $T_\infty/T_w = 4$; Eu = -0.0644; $f_w = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 7.219$; $\frac{\delta_i\sqrt{Re}}{x} = 3.484$; $\frac{\delta_c\sqrt{Re}}{x} = 2.620$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-0.500	0	0	0.016	0	0.080	-0.003	0	0
.2	-.500	.000	.003	.014	.016	.079	-.003	.000	.001
.4	-.500	.001	.006	.012	.032	.079	-.002	.001	.005
.6	-.500	.002	.008	.010	.048	.078	-.002	.003	.010
.8	-.499	.004	.010	.009	.063	.078	-.002	.005	.017
1.0	-.498	.006	.011	.008	.079	.078	-.001	.008	.025
1.2	-.496	.009	.013	.007	.094	.078	-.001	.011	.035
1.4	-.494	.011	.014	.006	.110	.077	-.001	.015	.046
1.6	-.492	.014	.015	.005	.125	.077	-.001	.020	.058
2.0	-.485	.021	.017	.004	.156	.077	-.001	.031	.084
2.4	-.475	.028	.019	.004	.187	.076	-.001	.044	.113
2.8	-.462	.036	.020	.003	.217	.076	-.001	.060	.144
3.2	-.446	.044	.021	.002	.248	.076	-.001	.077	.177
3.6	-.427	.053	.022	.002	.278	.076	-.001	.097	.211
4.0	-.404	.062	.022	.001	.308	.075	-.001	.119	.247
4.4	-.377	.071	.023	.001	.338	.075	-.001	.143	.283
4.8	-.347	.080	.023	.000	.368	.074	-.001	.168	.320
5.2	-.313	.089	.023	.000	.397	.074	-.002	.196	.357
5.6	-.276	.098	.023	-.000	.427	.073	-.002	.225	.394
6.0	-.235	.108	.023	-.001	.456	.072	-.002	.255	.431
6.4	-.190	.117	.023	-.001	.484	.071	-.003	.287	.468
6.8	-.141	.126	.022	-.001	.512	.070	-.003	.319	.504
7.2	-.089	.135	.022	-.002	.540	.068	-.004	.353	.539
8.0	.026	.152	.020	-.002	.593	.065	-.004	.422	.607
8.8	.153	.168	.019	-.002	.644	.062	-.005	.491	.670
9.6	.293	.182	.017	-.002	.692	.058	-.005	.560	.728
10.4	.444	.195	.015	-.002	.736	.053	-.006	.626	.780
11.2	.605	.206	.013	-.003	.777	.048	-.006	.687	.825
12.0	.774	.216	.011	-.002	.814	.043	-.006	.744	.864
12.8	.950	.224	.009	-.002	.847	.038	-.006	.794	.897
13.6	1.132	.231	.008	-.002	.875	.033	-.006	.838	.924
14.4	1.319	.236	.006	-.002	.900	.029	-.006	.875	.946
15.2	1.510	.241	.004	-.002	.921	.024	-.005	.906	.963
16.0	1.704	.244	.003	-.001	.939	.020	-.005	.931	.976
16.8	1.900	.246	.002	-.001	.954	.016	-.004	.950	.984
17.6	2.097	.248	.002	-.001	.965	.013	-.004	.965	.990
18.4	2.296	.249	.001	-.001	.975	.010	-.003	.976	.995
19.2	2.495	.249	.001	-.000	.982	.008	-.003	.984	.998
20.0	2.695	.250	.000	-.000	.988	.006	-.002	.990	1.000
20.8	2.895	.250	.000	-.000	.992	.004	-.002	.994	1.000
21.6	3.095	.250	.000	-.000	.995	.003	-.001	.996	1.000
22.4	3.295	.250	.000	-.000	.997	.002	-.001	.998	1.000
23.2	3.495	.250	.000	.000	.999	.002	-.001	.999	1.000
24.0	3.695	.250	.000	.000	1.000	.001	-.001	1.000	1.000
24.8	3.895	.250	.000	.000	1.000	.001	-.000	1.000	1.000
25.6	4.095	.250	.000	.000	1.000	.000	-.000	1.000	1.000
26.4	4.295	.250	.000	.000	1.000	.000	-.000	1.000	1.000
27.2	4.495	.250	.000	.000	1.000	.000	-.000	1.000	1.000
28.0	4.695	.250	.000	.000	1.000	.000	-.000	1.000	1.000
28.8	4.895	.250	.000	.000	1.000	.000	-.000	1.000	1.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(25) $T_\infty/T_w = 4$; $Eu = 0$; $f_w = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 2.460$; $\frac{\delta_1\sqrt{Re}}{x} = 3.100$; $\frac{\delta_c\sqrt{Re}}{x} = 3.236$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-0.500	0	0.126	-0.122	0	0.151	-0.031	0	0
.2	-.498	.023	.106	-.088	.030	.145	-.025	.025	.093
.4	-.491	.043	.090	-.066	.058	.140	-.021	.050	.171
.6	-.481	.060	.079	-.051	.086	.136	-.018	.075	.238
.8	-.467	.074	.070	-.041	.113	.133	-.016	.099	.297
1.0	-.451	.088	.062	-.033	.139	.130	-.014	.124	.350
1.2	-.432	.099	.056	-.028	.165	.127	-.013	.149	.398
1.4	-.412	.110	.051	-.023	.190	.125	-.012	.173	.441
1.6	-.388	.120	.047	-.020	.215	.123	-.011	.197	.480
1.8	-.364	.129	.043	-.017	.239	.120	-.011	.222	.516
2.0	-.337	.137	.040	-.015	.263	.118	-.010	.246	.549
2.2	-.309	.145	.037	-.014	.287	.116	-.010	.270	.580
2.4	-.279	.152	.034	-.012	.310	.114	-.010	.294	.609
2.6	-.248	.159	.032	-.011	.332	.112	-.010	.317	.636
2.8	-.216	.165	.030	-.010	.354	.110	-.010	.341	.660
3.2	-.147	.176	.026	-.008	.398	.106	-.010	.387	.706
3.6	-.075	.186	.023	-.007	.440	.102	-.010	.432	.746
4.0	.002	.195	.021	-.006	.480	.098	-.010	.476	.781
4.4	.081	.203	.018	-.006	.518	.094	-.010	.519	.812
4.8	.164	.210	.016	-.005	.555	.090	-.010	.560	.840
5.2	.249	.216	.014	-.004	.590	.086	-.011	.599	.864
5.6	.337	.221	.012	-.004	.624	.082	-.011	.636	.886
6.0	.426	.226	.011	-.004	.656	.077	-.011	.671	.904
6.4	.518	.230	.010	-.003	.686	.073	-.011	.704	.921
6.8	.610	.234	.008	-.003	.714	.069	-.011	.735	.935
7.2	.704	.237	.007	-.003	.741	.064	-.011	.763	.947
7.6	.800	.239	.006	-.002	.766	.060	-.010	.789	.958
8.0	.896	.242	.005	-.002	.789	.056	-.010	.814	.966
8.4	.993	.244	.004	-.002	.811	.052	-.010	.836	.974
8.8	1.090	.245	.004	-.002	.831	.048	-.010	.856	.980
9.2	1.189	.246	.003	-.002	.849	.044	-.009	.874	.986
9.6	1.288	.247	.002	-.001	.866	.041	-.009	.890	.990
10.0	1.387	.248	.002	-.001	.882	.037	-.009	.905	.993
10.4	1.486	.249	.001	-.001	.896	.034	-.008	.917	.995
10.8	1.586	.249	.001	-.001	.909	.030	-.008	.928	.997
11.2	1.685	.250	.001	-.001	.920	.027	-.007	.938	.998
11.6	1.785	.250	.000	-.001	.931	.025	-.007	.947	.999
12.0	1.885	.250	.000	-.001	.940	.022	-.006	.954	.999
12.4	1.985	.250	.000	.000	.948	.020	-.006	.960	.999
12.8	2.085				.956	.017	-.005	.966	
13.2	2.185				.962	.015	-.005	.971	
13.6	2.285				.968	.013	-.004	.975	
14.4	2.485				.978	.010	-.004	.982	
15.2	2.685				.985	.008	-.003	.988	
16.0	2.885				.990	.005	-.002	.992	
16.8	3.085				.994	.004	-.002	.994	
17.6	3.285				.996	.003	-.001	.996	
18.4	3.485				.998	.002	-.001	.998	
19.2	3.685				.999	.001	-.001	.999	
20.0	3.885				1.000	.001	.000	.999	
20.8	4.085				1.000	.000	.000	1.000	
21.6	4.285				1.000	.000	.000	1.000	
22.4	4.485				1.000	.000	.000	1.000	
23.2	4.685				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(26) $T_\infty/T_w = 4$; $Eu = 0.5$; $f_w = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 0.773$; $\frac{\delta_1\sqrt{Re}}{x} = 2.486$; $\frac{\delta_c\sqrt{Re}}{x} = 3.123$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-0.500	0	0.331	-0.539	0	0.201	-0.050	0	0
.2	-.494	.057	.243	-.352	.039	.192	-.037	.064	.228
.4	-.478	.099	.185	-.245	.077	.185	-.031	.122	.398
.6	-.455	.132	.143	-.177	.113	.180	-.026	.177	.528
.8	-.426	.157	.112	-.132	.149	.175	-.023	.228	.629
1.0	-.392	.177	.089	-.101	.183	.170	-.022	.275	.709
1.2	-.355	.193	.071	-.079	.217	.166	-.020	.319	.772
1.4	-.315	.206	.057	-.063	.250	.162	-.020	.360	.824
1.6	-.273	.216	.046	-.050	.282	.158	-.020	.399	.864
1.8	-.229	.224	.036	-.041	.313	.154	-.020	.435	.897
2.0	-.184	.231	.029	-.033	.343	.150	-.020	.469	.923
2.2	-.137	.236	.023	-.028	.373	.146	-.019	.500	.944
2.4	-.089	.240	.018	-.023	.402	.143	-.020	.530	.960
2.8	.008	.246	.010	-.016	.457	.135	-.020	.583	.983
3.2	.107	.249	.005	-.012	.510	.127	-.020	.629	.995
3.6	.207	.250	.001	-.008	.559	.119	-.020	.669	1.000
4.0	.307	.250	-.002	-.006	.604	.111	-.020	.703	
4.4	.407				.647	.103	-.020	.735	
4.8	.507				.686	.095	-.019	.765	
5.2	.607				.723	.087	-.019	.792	
5.6	.707				.756	.079	-.018	.817	
6.0	.807				.787	.072	-.018	.840	
6.4	.907				.814	.065	-.017	.861	
6.8	1.007				.839	.059	-.016	.879	
7.2	1.107				.861	.052	-.015	.896	
7.6	1.207				.881	.046	-.014	.911	
8.0	1.307				.899	.041	-.013	.924	
8.8	1.507				.927	.031	-.011	.946	
9.6	1.707				.949	.023	-.009	.962	
10.4	1.907				.965	.017	-.007	.974	
11.2	2.107				.977	.012	-.005	.982	
12.0	2.307				.985	.008	-.004	.989	
12.8	2.507				.990	.005	-.003	.993	
13.6	2.707				.994	.003	-.002	.995	
14.4	2.907				.996	.002	-.001	.997	
15.2	3.107				.997	.001	-.001	.998	
16.0	3.307				.998	.001	-.001	.998	
16.8	3.507				.998	.000	.000	.999	
17.6	3.707				.999	.000	.000	.999	
18.4	3.907				.999	.000	.000	.999	
19.2	4.107				.999	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(27) $T_\infty/T_w = 4$; Eu = 1.0; $f_w = -0.5$

$\frac{\delta^*\sqrt{Re}}{x} = 0.553$; $\frac{\delta_i\sqrt{Re}}{x} = 2.235$; $\frac{\delta_c\sqrt{Re}}{x} = 2.861$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-0.500	0	0.422	-0.768	0	0.213	-0.041	0	0
.2	-.492	.071	.298	-.499	.042	.206	-.031	.080	.285
.4	-.473	.122	.216	-.346	.083	.201	-.025	.152	.488
.6	-.445	.159	.156	-.242	.123	.196	-.022	.218	.637
.8	-.410	.186	.115	-.176	.161	.192	-.021	.276	.745
1.0	-.371	.206	.085	-.131	.199	.188	-.021	.329	.825
1.2	-.328	.221	.062	-.099	.236	.183	-.021	.377	.883
1.4	-.282	.231	.045	-.076	.272	.179	-.021	.420	.926
1.6	-.235	.239	.031	-.059	.308	.175	-.022	.460	.956
1.8	-.187	.244	.021	-.046	.342	.170	-.023	.495	.976
2.0	-.138	.247	.012	-.036	.376	.166	-.023	.526	.990
2.2	-.088	.249	.006	-.029	.409	.161	-.024	.555	.997
2.4	-.038	.250	.001	-.023	.440	.156	-.024	.580	1.000
2.8	.062				.501	.146	-.025	.626	
3.2	.162				.557	.136	-.026	.668	
3.6	.262				.610	.126	-.026	.707	
4.0	.362				.658	.115	-.026	.743	
4.4	.462				.702	.105	-.025	.776	
4.8	.562				.742	.095	-.024	.806	
5.2	.662				.778	.086	-.023	.834	
5.6	.762				.811	.076	-.022	.858	
6.0	.862				.839	.068	-.021	.880	
6.4	.962				.865	.059	-.020	.898	
6.8	1.062				.887	.052	-.018	.915	
7.2	1.162				.906	.045	-.017	.930	
7.6	1.262				.923	.038	-.015	.942	
8.0	1.362				.937	.033	-.014	.953	
8.4	1.462				.949	.027	-.012	.962	
8.8	1.562				.959	.023	-.011	.970	
9.6	1.762				.974	.015	-.008	.981	
10.4	1.962				.984	.010	-.005	.988	
11.2	2.162				.991	.006	-.004	.993	
12.0	2.362				.995	.004	-.002	.996	
12.8	2.562				.997	.002	-.002	.998	
13.6	2.762				.999	.001	-.001	.999	
14.4	2.962				1.000	.001	.000	1.000	
15.2	3.162				1.000	.000	.000	1.000	
16.0	3.362				1.000	.000	.000	1.000	
16.8	3.562				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(28) $T_\infty/T_w = 1$; $Eu = -0.0072$; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 6.398$; $\frac{\delta_i\sqrt{Re}}{x} = 1.116$; $\frac{\delta_c\sqrt{Re}}{x} = 1.072$

η	f	f'	f''	f'''	θ	θ'	θ''
0	-1.000	0	0	0.007	0	0.025	0.009
.50	-1.000	.001	.004	.009	.014	.030	.010
1.00	-.999	.004	.009	.012	.030	.036	.012
1.50	-.995	.011	.016	.015	.049	.042	.015
2.00	-.987	.021	.024	.019	.072	.050	.017
2.50	-.974	.035	.035	.024	.100	.060	.020
3.00	-.951	.056	.049	.030	.132	.070	.023
3.50	-.916	.085	.066	.037	.170	.083	.026
4.00	-.864	.123	.086	.044	.215	.097	.029
4.50	-.791	.172	.110	.050	.267	.112	.031
5.00	-.691	.233	.136	.053	.327	.127	.030
5.50	-.556	.308	.162	.051	.394	.142	.027
6.00	-.381	.395	.186	.041	.468	.154	.020
6.50	-.160	.492	.202	.022	.547	.161	.009
6.75	-.030	.543	.206	.008	.587	.162	.002
7.00	.112	.594	.206	-.007	.628	.162	-.006
7.25	.267	.646	.202	-.023	.668	.159	-.015
7.50	.434	.695	.194	-.038	.707	.155	-.023
7.75	.614	.742	.183	-.053	.745	.148	-.032
8.00	.806	.786	.168	-.065	.781	.139	-.039
8.25	1.007	.826	.151	-.073	.814	.128	-.045
8.50	1.218	.862	.132	-.078	.845	.116	-.049
8.75	1.438	.892	.112	-.079	.873	.104	-.052
9.00	1.664	.918	.093	-.076	.897	.091	-.052
9.25	1.896	.939	.075	-.070	.918	.078	-.051
9.50	2.133	.956	.059	-.062	.936	.065	-.048
9.75	2.374	.968	.044	-.052	.951	.054	-.044
10.00	2.617	.978	.033	-.042	.963	.043	-.039
10.25	2.863	.985	.023	-.033	.972	.034	-.034
10.50	3.110	.990	.016	-.025	.980	.026	-.028
10.75	3.357	.993	.011	-.018	.986	.020	-.023
11.00	3.606	.995	.007	-.013	.990	.015	-.018
11.25	3.855	.997	.004	-.008	.993	.011	-.014
11.50	4.104	.998	.003	-.006	.995	.008	-.011
11.75	4.354	.998	.002	-.004	.997	.005	-.008
12.00	4.603	.998	.001	-.002	.998	.004	-.006
12.25	4.853	.999	.000	-.001	.999	.002	-.004
12.50	5.103	.999	.000	-.001	.999	.002	-.003
12.75	5.352	.999	.000	.000	1.000	.001	-.002
13.00	5.602				1.000	.001	-.001
13.25	5.852				1.000	.000	-.001
13.50	6.102				1.000	.000	.000
13.75	6.352				1.000	.000	.000
14.00	6.602				1.000	.000	.000
14.25	6.852				1.000	.000	.000
14.50	7.102				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(29) $T_\infty/T_W = 1$; $Eu = 0$; $f_W = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 4.396$; $\frac{\delta_1\sqrt{Re}}{x} = 1.073$; $\frac{\delta_c\sqrt{Re}}{x} = 1.147$

η	f	f'	f''	f'''	θ	θ'	θ''
0	-1.000	0	0.036	0.018	0	0.052	0.018
.2	-.999	.008	.039	.020	.011	.055	.019
.4	-.997	.016	.043	.022	.022	.059	.021
.6	-.993	.025	.048	.024	.034	.064	.022
.8	-.987	.035	.053	.026	.048	.068	.024
1.0	-.979	.046	.058	.028	.062	.073	.025
1.2	-.969	.058	.064	.031	.077	.078	.027
1.4	-.956	.072	.071	.034	.093	.084	.028
1.6	-.940	.086	.078	.036	.110	.089	.029
1.8	-.921	.103	.085	.039	.129	.096	.031
2.0	-.899	.121	.094	.042	.149	.102	.032
2.2	-.873	.140	.102	.045	.170	.108	.033
2.4	-.842	.162	.111	.047	.192	.115	.034
2.6	-.808	.185	.121	.049	.216	.122	.034
2.8	-.768	.210	.131	.050	.241	.129	.035
3.0	-.724	.237	.141	.051	.267	.136	.034
3.2	-.673	.266	.151	.051	.295	.142	.034
3.4	-.617	.298	.161	.050	.324	.149	.032
3.6	-.554	.331	.171	.047	.354	.155	.030
3.8	-.485	.366	.180	.044	.386	.161	.027
4.0	-.408	.402	.188	.038	.419	.166	.024
4.2	-.323	.441	.195	.032	.452	.170	.019
4.4	-.231	.480	.201	.023	.487	.174	.014
4.6	-.131	.521	.204	.013	.522	.176	.008
4.8	-.023	.562	.206	.002	.557	.177	.001
5.0	.094	.604	.205	-.010	.592	.176	-.006
5.2	.219	.644	.202	-.022	.628	.174	-.013
5.4	.352	.684	.196	-.034	.662	.171	-.021
5.6	.492	.722	.188	-.046	.696	.166	-.029
5.8	.640	.760	.178	-.057	.728	.160	-.036
6.0	.796	.794	.166	-.066	.760	.152	-.042
6.2	.958	.826	.152	-.073	.789	.143	-.048
6.4	1.126	.854	.137	-.077	.817	.133	-.052
6.6	1.299	.880	.121	-.079	.842	.122	-.056
6.8	1.478	.902	.106	-.078	.865	.111	-.057
7.0	1.660	.922	.090	-.075	.886	.099	-.058
7.2	1.846	.939	.076	-.070	.907	.088	-.057
7.4	2.035	.952	.062	-.063	.923	.077	-.055
7.6	2.227	.964	.050	-.056	.937	.066	-.051
7.8	2.421	.973	.040	-.048	.950	.056	-.048
8.0	2.616	.980	.031	-.040	.960	.047	-.043
8.2	2.813	.986	.024	-.033	.968	.039	-.038
8.4	3.010	.990	.018	-.027	.975	.032	-.033
8.6	3.208	.992	.013	-.021	.981	.026	-.029
8.8	3.407	.994	.009	-.016	.986	.020	-.024
9.0	3.606	.996	.006	-.012	.989	.016	-.020
9.2	3.802	.998	.004	-.009	.992	.012	-.016
9.4	4.005	.998	.003	-.006	.994	.009	-.013
9.6	4.205	.998	.002	-.004	.996	.007	-.010
9.8	4.405	.999	.001	-.003	.996	.005	-.008
10.0	4.604	.999	.001	-.002	.998	.004	-.006
10.2	4.804	1.000	.000	-.001	.999	.003	-.005
10.4	5.004	1.000	.000	-.001	.999	.002	-.003
10.6	5.204	1.000	.000	.000	.999	.001	-.002
10.8	5.404	1.000	.000	.000	1.000	.001	-.002
11.0	5.604				1.000	.001	-.001
11.2	5.804				1.000	.000	-.001
11.4	6.004				1.000	.000	-.001
11.6	6.204				1.000	.000	.000
11.8	6.404				1.000	.000	.000
12.0	6.604				1.000	.000	.000
12.2	6.804				1.000	.000	.000
12.4	7.004				1.000	.000	.000
12.6	7.204				1.000	.000	.000
12.8	7.404				1.000	.000	.000
13.0	7.604				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(30) $T_\infty/T_w = 1$; Eu = 0.05; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 2.796$; $\frac{\delta_1\sqrt{Re}}{x} = 0.911$; $\frac{\delta_c\sqrt{Re}}{x} = 1.241$

η	f	f'	f''	f'''	θ	θ'	θ''
0	-1.000	0	0.141	0.024	0	0.088	0.032
.2	-.997	.029	.146	.026	.018	.095	.035
.4	-.988	.058	.152	.029	.038	.102	.037
.6	-.974	.089	.158	.031	.059	.110	.039
.8	-.953	.121	.164	.033	.082	.118	.041
1.0	-.925	.155	.171	.034	.106	.126	.043
1.2	-.891	.190	.178	.035	.132	.135	.044
1.4	-.849	.226	.184	.035	.160	.144	.045
1.6	-.800	.263	.191	.034	.190	.153	.045
1.8	-.744	.302	.198	.032	.221	.162	.044
2.0	-.679	.342	.204	.029	.254	.170	.042
2.2	-.607	.384	.209	.024	.289	.178	.040
2.4	-.526	.426	.214	.018	.326	.186	.036
2.6	-.436	.469	.216	.011	.364	.193	.031
2.8	-.338	.513	.218	.002	.403	.198	.025
3.0	-.231	.556	.217	-.008	.443	.203	.017
3.2	-.116	.599	.214	-.019	.484	.205	.009
3.4	.008	.642	.210	-.030	.525	.206	-.001
3.6	.141	.683	.202	-.042	.566	.205	-.011
3.8	.282	.723	.193	-.052	.607	.202	-.021
4.0	.430	.760	.182	-.062	.646	.197	-.031
4.2	.585	.795	.168	-.070	.685	.189	-.041
4.4	.748	.827	.154	-.076	.722	.180	-.050
4.6	.916	.856	.138	-.080	.757	.170	-.057
4.8	1.090	.882	.122	-.081	.790	.158	-.063
5.0	1.269	.905	.106	-.080	.820	.144	-.067
5.2	1.452	.925	.090	-.076	.848	.131	-.070
5.4	1.639	.942	.076	-.071	.872	.117	-.070
5.6	1.828	.955	.062	-.064	.894	.103	-.069
5.8	2.021	.966	.050	-.056	.914	.089	-.066
6.0	2.215	.975	.040	-.048	.930	.076	-.062
6.2	2.411	.982	.031	-.040	.944	.064	-.057
6.4	2.608	.988	.023	-.033	.956	.054	-.051
6.6	2.806	.992	.017	-.026	.966	.044	-.045
6.8	3.004	.995	.013	-.020	.974	.036	-.039
7.0	3.204	.997	.009	-.015	.980	.028	-.033
7.2	3.403	.998	.006	-.011	.985	.022	-.028
7.4	3.603	.999	.004	-.008	.989	.017	-.023
7.6	3.803	1.000	.003	-.006	.992	.013	-.018
7.8	4.003	1.000	.002	-.004	.994	.010	-.014
8.0	4.203	1.000	.001	-.003	.996	.007	-.011
8.2	4.403	1.000	.001	-.002	.997	.005	-.009
8.4	4.603	1.000	.000	-.001	.998	.004	-.006
8.6	4.803	1.000	.000	-.001	.999	.003	-.005
8.8	5.004	1.000	.000	.000	.999	.002	-.004
9.0	5.204	1.000	.000	.000	.999	.001	-.002
9.2	5.404				1.000	.001	-.002
9.4	5.604				1.000	.001	-.001
9.6	5.804				1.000	.000	-.001
9.8	6.004				1.000	.000	.000
10.0	6.204				1.000	.000	.000
10.2	6.404				1.000	.000	.000
10.4	6.604				1.000	.000	.000
10.6	6.804				1.000	.000	.000
10.8	7.004				1.000	.000	.000
11.0	7.204				1.000	.000	.000
11.2	7.404				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(31) $T_\infty/T_W = 1$; $Eu = 0.15$; $f_W = -1.0$

$$\frac{\delta^*\sqrt{Re}}{x} = 2.008; \frac{\delta_1\sqrt{Re}}{x} = 0.750; \frac{\delta_c\sqrt{Re}}{x} = 1.280$$

η	f	f'	f''	f'''	θ	θ'	θ''
0	-1.000	0	0.270	0.005	0	0.113	0.045
.2	-.995	.054	.271	.006	.024	.122	.049
.4	-.978	.109	.272	.005	.049	.132	.052
.6	-.951	.163	.273	.004	.076	.143	.055
.8	-.913	.218	.274	.001	.106	.154	.057
1.0	-.864	.273	.274	-.003	.138	.166	.058
1.2	-.804	.327	.273	-.008	.172	.177	.057
1.4	-.733	.382	.270	-.014	.209	.189	.056
1.6	-.651	.436	.267	-.022	.248	.199	.052
1.8	-.559	.488	.262	-.030	.289	.209	.047
2.0	-.456	.540	.255	-.039	.332	.218	.040
2.2	-.343	.590	.246	-.049	.376	.225	.031
2.4	-.220	.638	.235	-.059	.422	.230	.020
2.6	-.088	.684	.222	-.069	.468	.233	.008
2.8	.053	.727	.208	-.077	.515	.234	-.005
3.0	.203	.767	.192	-.084	.561	.231	-.019
3.2	.360	.804	.174	-.089	.607	.226	-.033
3.4	.524	.837	.156	-.092	.652	.218	-.046
3.6	.695	.866	.138	-.092	.694	.208	-.058
3.8	.870	.892	.119	-.090	.734	.195	-.068
4.0	1.051	.914	.102	-.086	.772	.181	-.076
4.2	1.236	.933	.085	-.080	.807	.165	-.082
4.4	1.424	.948	.070	-.072	.838	.148	-.085
4.6	1.615	.961	.056	-.064	.866	.131	-.085
4.8	1.808	.971	.044	-.055	.890	.114	-.083
5.0	2.003	.979	.034	-.046	.912	.098	-.079
5.2	2.200	.985	.026	-.037	.930	.083	-.073
5.4	2.397	.989	.019	-.030	.945	.069	-.066
5.6	2.595	.993	.014	-.023	.957	.056	-.059
5.8	2.794	.995	.010	-.018	.967	.045	-.051
6.0	2.993	.997	.007	-.013	.975	.036	-.043
6.2	3.193	.998	.005	-.009	.982	.028	-.036
6.4	3.393	.999	.003	-.007	.986	.021	-.029
6.6	3.592	.999	.002	-.004	.990	.016	-.023
6.8	3.792	1.000	.001	-.003	.993	.012	-.018
7.0	3.992	1.000	.001	-.002	.995	.009	-.014
7.2	4.192	1.000	.001	-.001	.997	.006	-.011
7.4	4.392	1.000	.000	-.001	.998	.004	-.008
7.6	4.592	1.000	.000	.000	.998	.003	-.006
7.8	4.792	1.000	.000	.000	.999	.002	-.004
8.0	4.992				.999	.001	-.003
8.2	5.192				1.000	.001	-.002
8.4	5.392				1.000	.001	-.001
8.6	5.592				1.000	.000	-.001
8.8	5.792				1.000	.000	.000
9.0	5.992				1.000	.000	.000
9.2	6.192				1.000	.000	.000
9.4	6.392				1.000	.000	.000
9.6	6.592				1.000	.000	.000
9.8	6.792				1.000	.000	.000
10.0	6.992				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

NACA

(32) $T_\infty/T_w = 1$; Eu = 0.5; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 1.252$; $\frac{\delta_1\sqrt{Re}}{x} = 0.524$; $\frac{\delta_c\sqrt{Re}}{x} = 1.269$

η	f	f'	f''	f'''	θ	θ'	θ''
0	-1.000	0	0.534	-0.099	0	0.139	0.073
.2	-.990	.105	.513	-.114	.029	.155	.080
.4	-.958	.205	.489	-.127	.062	.171	.086
.6	-.908	.300	.462	-.140	.098	.189	.090
.8	-.839	.390	.433	-.152	.138	.207	.091
1.0	-.752	.473	.402	-.161	.181	.225	.089
1.2	-.650	.550	.369	-.169	.228	.242	.083
1.4	-.533	.621	.334	-.174	.278	.258	.072
1.6	-.402	.684	.299	-.176	.331	.271	.057
1.8	-.259	.741	.264	-.174	.386	.281	.038
2.0	-.106	.790	.230	-.170	.443	.286	.016
2.2	.056	.833	.197	-.162	.500	.287	-.008
2.4	.226	.869	.166	-.151	.557	.283	-.034
2.6	.403	.899	.137	-.137	.613	.274	-.058
2.8	.586	.924	.111	-.122	.666	.260	-.080
3.0	.773	.944	.088	-.106	.716	.242	-.098
3.2	.963	.959	.068	-.089	.763	.220	-.112
3.4	1.156	.971	.052	-.074	.804	.197	-.120
3.6	1.351	.980	.039	-.059	.841	.173	-.123
3.8	1.548	.987	.028	-.046	.874	.149	-.121
4.0	1.746	.992	.020	-.035	.901	.125	-.115
4.2	1.945	.995	.014	-.026	.924	.103	-.105
4.4	2.144	.998	.010	-.018	.942	.083	-.094
4.6	2.344	.999	.007	-.013	.957	.066	-.081
4.8	2.544	1.000	.005	-.009	.969	.051	-.068
5.0	2.744	1.000	.003	-.006	.978	.038	-.055
5.2	2.944	1.000	.002	-.004	.984	.028	-.044
5.4	3.145	1.000	.002	-.002	.989	.021	-.034
5.6	3.345	1.000	.002	-.001	.993	.015	-.026
5.8	3.546	1.000	.001	-.001	.995	.010	-.019
6.0	3.746	1.000	.001	.000	.997	.007	-.014
6.2	3.947	1.000	.001	.000	.998	.005	-.010
6.4	4.148	1.000	.001	.000	.999	.003	-.007
6.6	4.348				.999	.002	-.004
6.8	4.548				1.000	.001	-.003
7.0	4.748				1.000	.001	-.002
7.2	4.948				1.000	.000	-.001
7.4	5.148				1.000	.000	-.001
7.6	5.348				1.000	.000	-.001
7.8	5.548				1.000	.000	.000
8.0	5.748				1.000	.000	.000
8.2	5.948				1.000	.000	.000
8.4	6.148				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(33) $T_\infty/T_W = 1$; Eu = 1.0; $f_W = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.945$; $\frac{\delta_1\sqrt{Re}}{x} = 0.405$; $\frac{\delta_c\sqrt{Re}}{x} = 1.208$

η	f	f'	f''	f'''	θ	θ'	θ''
0	-1.000	0	0.756	-0.244	0	0.146	0.102
.2	-.985	.146	.703	-.285	.031	.167	.115
.4	-.942	.281	.643	-.315	.067	.192	.126
.6	-.874	.403	.578	-.332	.108	.218	.133
.8	-.782	.512	.511	-.338	.154	.244	.134
1.0	-.670	.607	.444	-.334	.206	.271	.127
1.2	-.540	.690	.378	-.320	.262	.295	.111
1.4	-.395	.759	.316	-.299	.323	.315	.087
1.6	-.237	.816	.259	-.272	.388	.329	.055
1.8	-.069	.863	.208	-.241	.454	.336	.016
2.0	.107	.900	.163	-.208	.522	.335	-.025
2.2	.290	.928	.124	-.174	.588	.326	-.066
2.4	.478	.950	.093	-.142	.652	.309	-.104
2.6	.670	.966	.068	-.112	.711	.285	-.134
2.8	.864	.977	.048	-.086	.765	.256	-.155
3.0	1.061	.985	.033	-.064	.813	.224	-.166
3.2	1.258	.991	.022	-.046	.855	.190	-.168
3.4	1.457	.994	.014	-.032	.890	.157	-.160
3.6	1.656	.997	.009	-.021	.918	.126	-.147
3.8	1.856	.998	.005	-.014	.940	.099	-.128
4.0	2.055	.999	.003	-.009	.958	.075	-.108
4.2	2.255	.999	.002	-.005	.971	.056	-.088
4.4	2.455	1.000	.001	-.003	.980	.040	-.069
4.6	2.655	1.000	.001	-.002	.987	.028	-.052
4.8	2.855	1.000	.000	-.001	.992	.019	-.038
5.0	3.055	1.000	.000	.000	.995	.013	-.027
5.2	3.255	1.000	.000	.000	.997	.008	-.018
5.4	3.455	1.000	.000	.000	.998	.005	-.012
5.6	3.655	1.000	.000	.000	.999	.003	-.008
5.8	3.855				.999	.002	-.005
6.0	4.055				1.000	.001	-.003
6.2	4.255				1.000	.001	-.002
6.4	4.455				1.000	.000	-.001
6.6	4.655				1.000	.000	-.001
6.8	4.855				1.000	.000	.000
7.0	5.055				1.000	.000	.000
7.2	5.255				1.000	.000	.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(34) $T_\infty/T_w = 2$; Eu = 0; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 4.931$; $\frac{\delta_1\sqrt{Re}}{x} = 2.109$; $\frac{\delta_c\sqrt{Re}}{x} = 2.167$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.024	0.009	0	0.041	0.013	0	0
.2	-1.000	.005	.026	.010	.008	.043	.013	.005	.010
.4	-.998	.010	.028	.011	.017	.046	.014	.011	.021
.6	-.995	.016	.030	.011	.027	.049	.015	.017	.033
.8	-.991	.023	.033	.012	.037	.052	.015	.023	.045
1.0	-.986	.029	.035	.012	.048	.055	.016	.031	.059
1.2	-.980	.037	.037	.012	.059	.058	.017	.039	.073
1.4	-.972	.044	.040	.013	.071	.062	.017	.047	.089
1.6	-.962	.052	.042	.013	.083	.065	.017	.057	.105
2.0	-.937	.070	.048	.013	.111	.072	.018	.078	.141
2.4	-.905	.091	.053	.013	.141	.079	.018	.103	.181
2.8	-.865	.113	.058	.012	.174	.087	.018	.132	.226
3.2	-.815	.137	.062	.010	.210	.094	.017	.166	.274
3.6	-.755	.163	.066	.008	.249	.101	.016	.203	.325
4.0	-.684	.190	.069	.006	.291	.107	.014	.245	.380
4.4	-.603	.218	.071	.003	.334	.112	.012	.291	.436
4.8	-.510	.246	.072	.000	.380	.116	.009	.340	.493
5.2	-.406	.275	.071	-.003	.427	.119	.005	.392	.550
5.6	-.290	.303	.069	-.006	.475	.120	.001	.446	.605
6.0	-.164	.330	.066	-.009	.523	.119	-.003	.502	.659
6.4	-.027	.355	.062	-.012	.570	.118	-.007	.558	.710
6.8	.120	.379	.057	-.013	.617	.114	-.010	.612	.758
7.2	.276	.400	.051	-.014	.661	.109	-.014	.665	.801
7.6	.440	.420	.045	-.015	.704	.103	-.017	.715	.839
8.0	.611	.436	.039	-.015	.744	.096	-.019	.761	.873
8.4	.789	.451	.033	-.015	.781	.089	-.021	.803	.902
8.8	.972	.463	.027	-.014	.815	.080	-.021	.840	.926
9.2	1.159	.473	.022	-.012	.845	.072	-.022	.873	.946
9.6	1.350	.481	.017	-.011	.872	.063	-.021	.900	.962
10.4	1.739	.492	.010	-.008	.916	.047	-.019	.942	.983
11.2	2.135	.497	.005	-.005	.948	.032	-.016	.968	.995
12.0	2.534	.500	.002	-.002	.969	.021	-.012	.984	1.000
12.8	2.934	.500	.000	-.001	.982	.013	-.008	.992	1.000
13.6	3.335	.500	.000	.000	.990	.007	-.005	.996	1.000
14.4	3.735				.995	.004	-.003	.998	
15.2	4.135				.997	.002	-.001	1.000	
16.0	4.535				.998	.001	-.001	1.000	
16.8	4.935				.999	.000	-.001	1.000	
17.6	5.335				.999	.000	.000	1.000	
18.4	5.735				.999	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(35) $T_\infty/T_W = 2$; $Eu = 0.05$; $f_W = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 2.985$; $\frac{\delta_1\sqrt{Re}}{x} = 1.908$; $\frac{\delta_c\sqrt{Re}}{x} = 2.299$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.089	0.005	0	0.069	0.021	0	0
.2	-.998	.018	.090	.005	.014	.073	.022	.018	.036
.4	-.993	.036	.091	.005	.029	.078	.023	.037	.072
.6	-.984	.054	.092	.004	.045	.082	.023	.057	.109
.8	-.971	.073	.093	.004	.062	.087	.024	.077	.146
1.0	-.955	.091	.094	.003	.080	.092	.024	.099	.183
1.2	-.935	.110	.094	.002	.099	.097	.024	.121	.220
1.4	-.911	.129	.094	.000	.119	.102	.024	.144	.258
1.6	-.883	.148	.094	-.001	.140	.106	.023	.168	.295
1.8	-.852	.166	.094	-.003	.161	.111	.022	.193	.330
2.0	-.816	.185	.093	-.004	.184	.115	.021	.219	.370
2.4	-.735	.222	.091	-.007	.232	.123	.018	.274	.444
2.8	-.639	.258	.087	-.010	.283	.130	.015	.330	.515
3.2	-.529	.292	.083	-.013	.336	.135	.010	.390	.583
3.6	-.406	.324	.077	-.016	.390	.138	.005	.450	.647
4.0	-.270	.353	.070	-.018	.446	.139	-.001	.510	.706
4.4	-.124	.380	.063	-.018	.501	.138	-.006	.570	.759
4.8	.033	.403	.055	-.019	.555	.134	-.011	.627	.807
5.2	.198	.424	.048	-.019	.608	.129	-.016	.682	.848
5.6	.372	.442	.040	-.018	.659	.122	-.020	.732	.883
6.0	.551	.456	.033	-.017	.706	.114	-.023	.778	.912
6.4	.736	.468	.027	-.016	.749	.104	-.025	.819	.936
6.8	.925	.478	.021	-.014	.789	.094	-.026	.855	.955
7.2	1.118	.485	.016	-.012	.825	.084	-.026	.885	.970
7.6	1.313	.491	.012	-.010	.856	.073	-.026	.911	.981
8.0	1.510	.494	.008	-.008	.883	.063	-.025	.931	.989
8.4	1.708	.497	.005	-.006	.907	.054	-.023	.948	.994
8.8	1.908	.499	.003	-.004	.926	.045	-.021	.961	.998
9.2	2.108	.500	.002	-.003	.943	.037	-.019	.971	1.000
9.6	2.308	.500	.000	-.002	.956	.030	-.017	.978	1.000
10.0	2.508	.500	.000	-.001	.967	.023	-.014	.984	1.000
10.4	2.708				.975	.018	-.012	.988	
10.8	2.908				.981	.014	-.009	.991	
11.2	3.108				.986	.011	-.008	.994	
11.6	3.308				.990	.008	-.006	.996	
12.0	3.508				.993	.006	-.005	.997	
12.4	3.708				.995	.004	-.003	.998	
12.8	3.908				.996	.003	-.003	.999	
13.2	4.108				.997	.002	-.002	.999	
13.6	4.308				.998	.001	-.001	1.000	
14.0	4.508				.998	.001	-.001	1.000	
14.4	4.708				.998	.000	-.001	1.000	
14.8	4.908				.999	.000	.000	1.000	
15.2	5.108				.999	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(36) $T_\infty/T_w = 2$; Eu = 0.15; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 1.989$; $\frac{\delta_1\sqrt{Re}}{x} = 1.710$; $\frac{\delta_c\sqrt{Re}}{x} = 2.343$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.168	-0.019	0	0.089	0.029	0	0
.2	-.997	.033	.164	-.020	.018	.094	.030	.034	.066
.4	-.987	.066	.160	-.022	.038	.100	.031	.068	.131
.6	-.970	.097	.155	-.024	.058	.107	.031	.103	.194
.8	-.948	.128	.150	-.026	.080	.113	.031	.138	.255
1.0	-.920	.157	.145	-.028	.103	.119	.030	.173	.314
1.2	-.885	.186	.139	-.030	.128	.125	.029	.209	.371
1.4	-.845	.213	.133	-.031	.153	.131	.028	.245	.425
1.6	-.800	.239	.126	-.033	.180	.136	.026	.282	.477
1.8	-.750	.263	.120	-.034	.208	.141	.024	.318	.526
2.0	-.695	.286	.113	-.035	.236	.146	.021	.354	.573
2.2	-.636	.308	.106	-.035	.266	.149	.018	.390	.617
2.4	-.572	.329	.099	-.035	.296	.153	.014	.426	.658
2.6	-.504	.348	.092	-.035	.327	.155	.011	.462	.696
2.8	-.433	.366	.085	-.035	.358	.157	.007	.496	.731
3.0	-.358	.382	.078	-.034	.389	.158	.003	.531	.764
3.2	-.280	.397	.071	-.033	.421	.158	-.001	.564	.794
3.4	-.199	.410	.065	-.032	.453	.158	-.005	.596	.821
3.6	-.116	.423	.058	-.030	.484	.156	-.008	.627	.845
3.8	-.030	.434	.052	-.029	.515	.154	-.012	.657	.868
4.0	.058	.444	.047	-.027	.546	.151	-.015	.686	.887
4.2	.147	.453	.042	-.026	.576	.148	-.018	.713	.905
4.4	.238	.460	.037	-.024	.605	.144	-.021	.739	.921
4.6	.331	.467	.032	-.022	.633	.140	-.024	.763	.935
4.8	.425	.473	.028	-.020	.661	.135	-.026	.786	.947
5.0	.521	.478	.024	-.019	.687	.129	-.028	.807	.957
5.2	.617	.483	.020	-.017	.712	.124	-.029	.827	.966
5.4	.714	.487	.017	-.015	.736	.118	-.030	.845	.973
5.6	.811	.490	.014	-.014	.759	.111	-.031	.862	.979
5.8	.910	.492	.012	-.012	.781	.105	-.032	.877	.985
6.0	1.008	.494	.009	-.011	.801	.099	-.032	.891	.989
6.2	1.107	.496	.007	-.010	.821	.092	-.032	.903	.992
6.4	1.207	.497	.005	-.008	.838	.086	-.031	.914	.995
6.8	1.406	.499	.002	-.006	.870	.074	-.030	.933	.998
7.2	1.606	.500	.000	-.004	.898	.062	-.028	.948	.999
7.6	1.806				.920	.051	-.025	.959	
8.0	2.006				.939	.042	-.023	.968	
8.4	2.206				.953	.033	-.019	.976	
8.8	2.406				.965	.026	-.016	.982	
9.2	2.606				.974	.020	-.014	.986	
9.6	2.806				.981	.015	-.011	.990	
10.0	3.006				.987	.011	-.008	.992	
10.4	3.206				.990	.008	-.007	.994	
10.8	3.406				.993	.006	-.005	.996	
11.2	3.606				.995	.004	-.004	.997	
11.6	3.806				.997	.003	-.003	.997	
12.0	4.006				.998	.002	-.002	.998	
12.4	4.206				.998	.001	-.001	.998	
12.8	4.406				.999	.001	-.001	.998	
13.2	4.606				.999	.001	.000	.998	
13.6	4.806				.999	.000	.000	.999	
14.0	5.006				.999	.000	.000		
14.4	5.206				.999	.000	.000		

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(37) $T_\infty/T_w = 2$; $Eu = 0.4$; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 1.245$; $\frac{\delta_1\sqrt{Re}}{x} = 1.476$; $\frac{\delta_c\sqrt{Re}}{x} = 2.320$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.287	-0.079	0	0.103	0.041	0	0
.2	-.994	.056	.270	-.084	.021	.111	.043	.057	.111
.4	-.978	.108	.253	-.089	.045	.120	.044	.113	.216
.6	-.952	.157	.235	-.092	.069	.129	.044	.168	.314
.8	-.916	.202	.216	-.094	.096	.138	.043	.221	.404
1.0	-.871	.243	.197	-.095	.124	.146	.042	.274	.486
1.2	-.819	.281	.178	-.094	.154	.154	.039	.324	.561
1.4	-.759	.314	.160	-.091	.186	.162	.035	.373	.629
1.6	-.693	.345	.142	-.088	.219	.168	.030	.420	.689
1.8	-.621	.371	.125	-.083	.253	.174	.025	.465	.742
2.0	-.545	.394	.109	-.078	.288	.178	.019	.508	.789
2.2	-.464	.415	.094	-.072	.324	.181	.013	.549	.829
2.4	-.379	.432	.080	-.065	.361	.183	.007	.588	.864
2.6	-.291	.447	.068	-.059	.398	.184	.000	.624	.894
2.8	-.201	.459	.056	-.053	.435	.184	-.006	.659	.918
3.0	-.108	.469	.046	-.047	.471	.182	-.012	.691	.939
3.2	-.013	.478	.037	-.042	.507	.179	-.017	.720	.956
3.4	.083	.484	.030	-.037	.543	.175	-.022	.747	.969
3.6	.181	.490	.023	-.032	.577	.170	-.027	.772	.979
3.8	.279	.494	.017	-.027	.611	.164	-.031	.795	.987
4.0	.378	.497	.012	-.024	.643	.158	-.034	.816	.993
4.2	.478	.498	.008	-.020	.674	.151	-.037	.834	.997
4.4	.577	.500	.004	-.017	.703	.143	-.039	.851	.999
4.6	.677	.500	.001	-.014	.731	.135	-.040	.865	1.000
4.8	.777				.757	.127	-.041	.878	
5.0	.877				.782	.119	-.042	.891	
5.2	.977				.805	.111	-.042	.902	
5.6	1.177				.846	.094	-.040	.923	
6.0	1.377				.880	.079	-.038	.940	
6.4	1.577				.909	.064	-.034	.954	
6.8	1.777				.932	.051	-.030	.966	
7.2	1.977				.950	.040	-.026	.975	
7.6	2.177				.964	.031	-.021	.982	
8.0	2.377				.975	.023	-.017	.988	
8.4	2.577				.983	.017	-.014	.992	
8.8	2.777				.989	.012	-.010	.994	
9.2	2.977				.993	.008	-.008	.996	
9.6	3.177				.995	.006	-.006	.998	
10.0	3.377				.997	.004	-.004	.999	
10.4	3.577				.998	.002	-.002	.999	
10.8	3.777				.999	.002	-.002	1.000	
11.2	3.977				1.000	.001	-.001	1.000	
11.6	4.177				1.000	.001	-.001	1.000	
12.0	4.377				1.000	.000	-.001	1.000	
12.4	4.577				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(38) $T_\infty/T_w = 2$; $Eu = 0.5$; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 1.114$; $\frac{\delta_1\sqrt{Re}}{x} = 1.428$; $\frac{\delta_c\sqrt{Re}}{x} = 2.289$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.320	-0.100	0	0.104	0.046	0	0
.2	-.994	.062	.300	-.108	.022	.114	.048	.063	.124
.4	-.976	.120	.278	-.113	.046	.124	.049	.125	.240
.6	-.946	.173	.255	-.117	.071	.133	.049	.185	.346
.8	-.907	.222	.231	-.118	.099	.143	.048	.243	.443
1.0	-.858	.265	.208	-.117	.128	.153	.046	.300	.531
1.2	-.801	.305	.184	-.114	.160	.162	.043	.353	.609
1.4	-.736	.339	.162	-.109	.193	.170	.038	.405	.678
1.6	-.665	.369	.141	-.103	.228	.177	.032	.454	.739
1.8	-.589	.396	.121	-.096	.264	.182	.026	.500	.791
2.0	-.508	.418	.102	-.088	.301	.187	.019	.543	.836
2.2	-.422	.437	.086	-.079	.338	.190	.012	.584	.873
2.4	-.333	.452	.071	-.071	.377	.192	.004	.622	.904
2.6	-.241	.465	.057	-.063	.415	.192	-.003	.658	.930
2.8	-.147	.475	.045	-.055	.453	.191	-.010	.691	.950
3.2	.046	.489	.026	-.041	.529	.184	-.022	.748	.979
3.6	.243	.497	.012	-.030	.600	.173	-.032	.795	.994
4.0	.443	.500	.002	-.021	.667	.159	-.039	.833	.999
4.4	.643				.727	.142	-.043	.863	
4.8	.843				.781	.125	-.045	.890	
5.2	1.043				.827	.107	-.044	.913	
5.6	1.243				.866	.089	-.042	.932	
6.0	1.443				.899	.073	-.039	.949	
6.4	1.643				.925	.058	-.034	.962	
6.8	1.843				.946	.046	-.029	.972	
7.2	2.043				.962	.035	-.025	.980	
7.6	2.243				.974	.026	-.020	.986	
8.0	2.443				.983	.019	-.015	.990	
8.4	2.643				.989	.013	-.012	.994	
8.8	2.843				.993	.009	-.009	.996	
9.2	3.043				.996	.006	-.006	.997	
9.6	3.243				.998	.004	-.004	.998	
10.0	3.443				1.000	.002	-.003	.999	
10.4	3.643				1.000	.001	-.002	.999	
10.8	3.843				1.000	.001	-.001	1.000	
11.2	4.043				1.000	.000	-.001	1.000	
11.6	4.243				1.000	.000	.000	1.000	
12.0	4.443				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(39) $T_\infty/T_w = 2$; Eu = 1; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.793$; $\frac{\delta_1\sqrt{Re}}{x} = 1.289$; $\frac{\delta_c\sqrt{Re}}{x} = 2.206$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.441	-0.181	0	0.102	0.063	0	0
.2	-.992	.084	.402	-.202	.022	.115	.068	.086	.169
.4	-.967	.161	.361	-.215	.046	.129	.071	.168	.321
.6	-.928	.229	.317	-.219	.074	.144	.073	.245	.457
.8	-.876	.288	.273	-.217	.104	.158	.072	.318	.575
1.0	-.813	.338	.231	-.208	.137	.172	.068	.384	.676
1.2	-.741	.380	.190	-.194	.173	.185	.062	.446	.760
1.4	-.662	.414	.153	-.176	.211	.197	.053	.502	.829
1.6	-.576	.442	.120	-.157	.251	.206	.043	.553	.883
1.8	-.485	.463	.090	-.137	.293	.214	.031	.598	.925
2.0	-.391	.478	.065	-.117	.336	.219	.019	.639	.956
2.2	-.294	.489	.043	-.100	.380	.221	.007	.675	.978
2.4	-.196	.496	.025	-.083	.425	.222	-.005	.706	.992
2.6	-.096	.499	.010	-.070	.469	.219	-.016	.733	.998
2.8	.004	.500	-.003	-.058	.513	.215	-.026	.756	1.000
3.0	.104				.555	.209	-.035	.777	
3.2	.204				.596	.201	-.043	.798	
3.6	.404				.673	.182	-.053	.836	
4.0	.604				.741	.159	-.059	.870	
4.4	.804				.800	.135	-.060	.900	
4.8	1.004				.850	.111	-.058	.924	
5.2	1.204				.890	.089	-.053	.944	
5.6	1.404				.921	.069	-.046	.960	
6.0	1.604				.945	.052	-.039	.972	
6.4	1.804				.963	.038	-.031	.981	
6.8	2.004				.976	.027	-.024	.988	
7.2	2.204				.985	.018	-.018	.992	
7.6	2.404				.991	.012	-.013	.995	
8.0	2.604				.995	.008	-.009	.997	
8.4	2.804				.998	.005	-.006	.998	
8.8	3.004				.999	.003	-.004	.999	
9.2	3.204				1.000	.002	-.002	1.000	
9.6	3.404				1.000	.001	-.001	1.000	
10.0	3.604				1.000	.000	-.001	1.000	
10.4	3.804				1.000	.000	.000	1.000	
10.8	4.004				1.000	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(40) $T_\infty/T_w = 4$; Eu = 0; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 6.409$; $\frac{\delta_1\sqrt{Re}}{x} = 4.161$; $\frac{\delta_{c_w}\sqrt{Re}}{x} = 4.002$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.012	0.004	0	0.026	0.007	0	0
.2	-1.000	.003	.013	.004	.005	.028	.008	.003	.010
.4	-.999	.005	.014	.004	.011	.029	.008	.006	.021
.6	-.998	.008	.015	.004	.017	.031	.008	.009	.033
.8	-.996	.011	.015	.004	.023	.032	.008	.012	.045
1.0	-.993	.014	.016	.004	.030	.034	.008	.016	.057
1.2	-.990	.018	.017	.004	.037	.036	.009	.020	.071
1.4	-.986	.021	.018	.004	.044	.038	.009	.024	.084
1.6	-.982	.025	.018	.003	.052	.039	.009	.028	.099
1.8	-.976	.028	.019	.003	.060	.041	.009	.034	.114
2.0	-.970	.032	.020	.003	.069	.043	.009	.039	.129
2.2	-.963	.036	.020	.003	.077	.045	.009	.045	.145
2.4	-.956	.040	.021	.003	.087	.047	.009	.051	.161
2.8	-.938	.049	.022	.002	.106	.050	.009	.064	.196
3.2	-.916	.058	.023	.002	.127	.054	.009	.080	.231
3.6	-.892	.067	.023	.002	.149	.057	.008	.097	.268
4.0	-.863	.077	.024	.001	.172	.060	.008	.116	.306
4.4	-.836	.086	.024	.001	.197	.063	.007	.137	.345
4.8	-.794	.096	.024	.000	.223	.066	.006	.160	.384
5.2	-.753	.106	.024	.000	.250	.068	.006	.185	.423
5.6	-.709	.116	.024	-.001	.277	.070	.005	.212	.462
6.0	-.661	.125	.024	-.001	.306	.072	.004	.240	.500
6.4	-.609	.134	.023	-.002	.335	.074	.003	.270	.538
6.8	-.554	.144	.023	-.002	.365	.075	.002	.301	.574
7.2	-.494	.152	.022	-.002	.395	.075	.001	.333	.610
7.6	-.432	.161	.021	-.002	.425	.076	.000	.366	.644
8.0	-.366	.169	.020	-.002	.455	.075	-.001	.400	.677
8.4	-.296	.177	.019	-.003	.485	.075	-.002	.435	.708
8.8	-.224	.184	.018	-.003	.515	.074	-.002	.469	.737
9.2	-.149	.191	.017	-.003	.545	.073	-.003	.504	.765
9.6	-.071	.198	.016	-.003	.574	.072	-.004	.538	.791
10.0	.009	.204	.014	-.003	.602	.070	-.005	.572	.815
10.4	.092	.209	.013	-.003	.630	.068	-.005	.605	.837
10.8	.176	.214	.012	-.003	.657	.066	-.006	.637	.858
11.2	.263	.219	.011	-.003	.683	.064	-.006	.668	.876
11.6	.352	.223	.010	-.003	.708	.061	-.007	.698	.894
12.0	.442	.227	.009	-.002	.731	.058	-.007	.726	.909
12.8	.626	.234	.007	-.002	.776	.053	-.007	.778	.935
13.6	.815	.239	.006	-.002	.815	.047	-.007	.823	.956
14.4	1.008	.243	.004	-.002	.850	.041	-.007	.862	.971
15.2	1.203	.246	.003	-.001	.881	.035	-.007	.894	.982
16.0	1.401	.248	.002	-.001	.906	.029	-.007	.920	.990
16.8	1.599	.249	.001	-.001	.928	.024	-.006	.941	.995
17.6	1.798	.249	.001	-.001	.945	.020	-.005	.957	.998
18.4	1.998	.250	.000	.000	.960	.016	-.005	.968	.999
19.2	2.198	.250	.000	.000	.971	.012	-.004	.977	.999
20.0	2.398				.977	.009	-.003	.982	
20.8	2.598				.984	.007	-.003	.987	
21.6	2.798				.989	.005	-.002	.991	
22.4	2.998				.992	.004	-.002	.994	
23.2	3.198				.995	.003	-.001	.995	
24.0	3.398				.997	.002	-.001	.997	
24.8	3.598				.998	.001	-.001	.998	
25.6	3.798				.999	.001	.000	.998	
26.4	3.998				.999	.000	.000	.998	
27.2	4.198				.999	.000	.000	.999	
28.0	4.398				1.000	.000	.000	.999	
28.8	4.598				1.000	.000	.000	.999	
29.6	4.798				1.000	.000	.000	.999	
30.4	4.998				1.000	.000	.000	.999	
31.2	5.198				1.000	.000	.000	.999	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(41) $T_\infty/T_w = 4$; $Eu = 0.05$; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 3.405$; $\frac{\delta_1\sqrt{Re}}{x} = 3.859$; $\frac{\delta_c\sqrt{Re}}{x} = 4.248$

NACA

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.054	-0.006	0	0.051	0.012	0	0
.4	-.996	.021	.052	-.007	.021	.056	.012	.023	.085
.8	-.983	.041	.049	-.007	.044	.061	.012	.047	.165
1.2	-.963	.060	.046	-.007	.070	.065	.011	.073	.241
1.6	-.935	.078	.043	-.007	.097	.070	.011	.101	.313
2.0	-.900	.095	.040	-.007	.125	.074	.010	.131	.380
2.4	-.859	.111	.038	-.007	.155	.077	.009	.162	.443
2.8	-.812	.125	.035	-.007	.187	.080	.007	.196	.501
3.2	-.759	.139	.032	-.007	.220	.083	.006	.229	.555
3.6	-.701	.151	.030	-.006	.253	.085	.005	.266	.605
4.0	-.638	.163	.027	-.006	.288	.087	.003	.303	.650
4.4	-.571	.173	.025	-.006	.322	.088	.002	.340	.692
4.8	-.500	.182	.023	-.005	.358	.088	.000	.378	.730
5.2	-.425	.191	.021	-.005	.393	.088	-.001	.416	.765
5.6	-.347	.199	.019	-.005	.428	.088	-.002	.454	.796
6.0	-.266	.206	.017	-.004	.463	.087	-.003	.492	.824
6.4	-.182	.212	.015	-.004	.497	.085	-.004	.530	.850
6.8	-.096	.218	.014	-.004	.531	.083	-.005	.566	.873
7.2	-.008	.223	.012	-.004	.564	.081	-.006	.601	.893
7.6	.082	.228	.010	-.003	.596	.079	-.007	.635	.911
8.0	.174	.232	.009	-.003	.627	.076	-.008	.668	.927
8.4	.268	.235	.008	-.003	.656	.073	-.008	.698	.941
8.8	.362	.238	.007	-.003	.685	.069	-.008	.728	.953
9.2	.458	.241	.006	-.002	.712	.066	-.009	.755	.963
9.6	.555	.243	.005	-.002	.738	.062	-.009	.781	.972
10.4	.751	.246	.003	-.002	.785	.055	-.009	.826	.986
11.2	.949	.249	.002	-.001	.826	.048	-.009	.864	.994
12.0	1.148	.250	.001	-.001	.861	.041	-.009	.896	1.000
12.8	1.348	.250	.000	-.001	.891	.034	-.008	.920	1.000
13.6	1.549	.250	.000	-.001	.916	.028	-.007	.940	1.000
14.4	1.749				.937	.023	-.006	.955	
15.2	1.949				.953	.018	-.005	.967	
16.0	2.149				.965	.014	-.005	.976	
16.8	2.349				.975	.010	-.004	.984	
17.6	2.549				.982	.008	-.003	.989	
18.4	2.749				.988	.006	-.002	.993	
19.2	2.949				.991	.004	-.002	.996	
20.0	3.149				.994	.003	-.001	.998	
20.8	3.349				.996	.002	-.001	1.000	
21.6	3.549				.997	.001	-.001	1.000	
22.4	3.749				.998	.001	.000	1.000	
23.2	3.949				.999	.000	.000	1.000	
24.0	4.149				.999	.000	.000	1.000	
24.8	4.349				.999	.000	.000	1.000	
25.6	4.549				.999	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(42) $T_\infty/T_w = 4$; Eu = 0.15; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 2.040$; $\frac{\delta_1\sqrt{Re}}{x} = 3.640$; $\frac{\delta_c\sqrt{Re}}{x} = 4.309$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.103	-0.033	0	0.066	0.015	0	0
.2	-.998	.020	.096	-.032	.013	.069	.015	.021	.080
.4	-.992	.039	.090	-.031	.027	.072	.015	.042	.155
.6	-.983	.056	.084	-.030	.042	.075	.015	.063	.224
.8	-.970	.072	.078	-.028	.057	.078	.014	.085	.290
1.0	-.954	.088	.073	-.027	.073	.080	.014	.107	.350
1.2	-.935	.102	.068	-.026	.089	.083	.013	.129	.406
1.4	-.913	.115	.063	-.024	.106	.086	.012	.151	.458
1.6	-.889	.127	.058	-.023	.124	.088	.011	.174	.507
1.8	-.863	.138	.054	-.022	.141	.090	.010	.196	.551
2.0	-.834	.148	.049	-.020	.160	.092	.009	.219	.592
2.4	-.771	.166	.042	-.017	.197	.095	.007	.265	.665
2.8	-.701	.182	.035	-.015	.236	.098	.005	.310	.727
3.2	-.626	.195	.030	-.013	.275	.099	.003	.355	.779
3.6	-.546	.206	.025	-.011	.315	.100	.001	.400	.822
4.0	-.462	.215	.021	-.010	.355	.100	-.001	.444	.859
4.4	-.374	.222	.017	-.008	.395	.100	-.003	.486	.889
4.8	-.284	.228	.014	-.007	.435	.098	-.004	.526	.914
5.2	-.192	.234	.012	-.006	.474	.096	-.006	.566	.935
5.6	-.097	.238	.009	-.005	.512	.094	-.007	.603	.952
6.0	-.002	.241	.007	-.004	.549	.091	-.008	.638	.965
6.4	.095	.244	.006	-.004	.584	.087	-.009	.672	.976
6.8	.193	.246	.004	-.003	.618	.084	-.009	.702	.984
7.2	.292	.247	.003	-.003	.651	.080	-.010	.731	.990
7.6	.391	.248	.002	-.002	.682	.076	-.011	.757	.994
8.0	.490	.249	.001	-.002	.712	.072	-.011	.781	.996
8.4	.590	.250	.000	-.002	.740	.067	-.011	.803	.998
8.8	.690	.250	.000	-.001	.766	.063	-.011	.823	.998
9.2	.790				.790	.059	-.011	.841	
9.6	.890				.813	.054	-.011	.858	
10.0	.990				.834	.050	-.010	.874	
10.4	1.090				.853	.046	-.010	.888	
11.2	1.290				.886	.038	-.009	.913	
12.0	1.490				.914	.031	-.008	.934	
12.8	1.690				.936	.024	-.007	.950	
13.6	1.890				.953	.019	-.006	.964	
14.4	2.090				.967	.014	-.005	.973	
15.2	2.290				.977	.011	-.004	.981	
16.0	2.490				.984	.008	-.003	.987	
16.8	2.690				.990	.006	-.003	.991	
17.6	2.890				.994	.004	-.002	.994	
18.4	3.090				.996	.003	-.001	.996	
19.2	3.290				.998	.002	-.001	.997	
20.0	3.490				.999	.001	-.001	.998	
20.8	3.690				1.000	.001	.000	.998	
21.6	3.890				1.000	.000	.000	.999	
22.4	4.090				1.000	.000	.000	.999	
23.2	4.290				1.000	.000	.000	.999	
24.0	4.490				1.000	.000	.000	.999	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(43) $T_\infty/T_w = 4$; Eu = 0.4; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 1.156$; $\frac{\delta_1\sqrt{Re}}{x} = 3.362$; $\frac{\delta_c\sqrt{Re}}{x} = 4.266$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.170	-0.081	0	0.073	0.022	0	0
.2	-.997	.032	.154	-.078	.015	.077	.022	.034	.130
.4	-.987	.062	.139	-.075	.031	.081	.022	.068	.247
.6	-.972	.088	.124	-.071	.047	.086	.021	.101	.352
.8	-.952	.112	.111	-.066	.065	.090	.020	.133	.446
1.0	-.928	.132	.098	-.062	.083	.094	.019	.166	.530
1.2	-.899	.151	.086	-.057	.103	.097	.017	.197	.603
1.4	-.868	.167	.075	-.052	.122	.101	.016	.228	.668
1.6	-.833	.181	.066	-.047	.143	.104	.014	.258	.724
1.8	-.795	.193	.057	-.042	.164	.106	.012	.288	.773
2.0	-.756	.204	.049	-.037	.185	.109	.011	.317	.815
2.2	-.714	.213	.042	-.034	.207	.111	.009	.345	.851
2.4	-.671	.220	.035	-.030	.230	.112	.007	.372	.882
2.6	-.626	.227	.030	-.026	.252	.114	.005	.399	.908
2.8	-.580	.232	.025	-.023	.275	.114	.004	.424	.929
3.2	-.485	.240	.017	-.018	.321	.115	.000	.472	.962
3.6	-.388	.246	.010	-.014	.367	.115	-.003	.517	.983
4.0	-.289	.249	.005	-.011	.413	.113	-.005	.557	.996
4.4	-.189	.250	.002	-.008	.458	.111	-.007	.594	1.000
4.8	-.089	.250	-.002	-.006	.501	.108	-.009	.627	
5.2	.011				.544	.104	-.011	.658	
5.6	.111				.584	.099	-.012	.689	
6.0	.211				.623	.094	-.013	.718	
6.4	.311				.660	.089	-.013	.746	
6.8	.411				.694	.084	-.014	.772	
7.2	.511				.727	.078	-.014	.796	
7.6	.611				.757	.072	-.014	.818	
8.0	.711				.784	.067	-.014	.839	
8.4	.811				.810	.061	-.014	.858	
8.8	.911				.833	.056	-.013	.876	
9.2	1.011				.855	.051	-.013	.892	
9.6	1.111				.874	.046	-.012	.906	
10.0	1.211				.891	.041	-.011	.919	
10.4	1.311				.906	.036	-.011	.931	
11.2	1.511				.932	.028	-.009	.950	
12.0	1.711				.952	.021	-.007	.965	
12.8	1.911				.967	.016	-.006	.976	
13.6	2.111				.978	.012	-.005	.984	
14.4	2.311				.986	.008	-.004	.990	
15.2	2.511				.991	.005	-.003	.994	
16.0	2.711				.995	.003	-.002	.997	
16.8	2.911				.997	.002	-.001	.999	
17.6	3.111				.998	.001	-.001	1.000	
18.4	3.311				.999	.001	-.001		
19.2	3.511				1.000	.000	.000		
20.0	3.711				1.000	.000	.000		
20.8	3.911				1.000	.000	.000		
21.6	4.111				1.000	.000	.000		

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(44) $T_\infty/T_w = 4$; Eu = 0.5; $f_w = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 1.016$; $\frac{\delta_1\sqrt{Re}}{x} = 3.299$; $\frac{\delta_c\sqrt{Re}}{x} = 4.254$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.188	-0.093	0	0.072	0.024	0	0
.2	-.996	.036	.170	-.091	.015	.077	.025	.037	.143
.4	-.986	.068	.152	-.088	.031	.081	.024	.074	.272
.6	-.970	.096	.135	-.084	.047	.087	.024	.110	.386
.8	-.948	.122	.118	-.079	.065	.091	.023	.146	.487
1.0	-.921	.144	.103	-.073	.084	.096	.021	.180	.576
1.2	-.890	.163	.089	-.066	.103	.100	.020	.214	.653
1.4	-.856	.180	.077	-.060	.124	.103	.018	.247	.720
1.6	-.818	.194	.065	-.054	.145	.107	.016	.278	.776
1.8	-.778	.206	.055	-.048	.166	.110	.014	.309	.824
2.0	-.736	.216	.046	-.043	.188	.112	.012	.338	.864
2.2	-.692	.224	.038	-.038	.211	.115	.010	.367	.898
2.4	-.646	.231	.031	-.033	.234	.116	.007	.394	.926
2.8	-.552	.241	.020	-.025	.281	.119	.004	.445	.966
3.2	-.454	.247	.011	-.019	.329	.119	.000	.491	.990
3.6	-.354	.250	.004	-.015	.376	.119	-.003	.533	1.000
4.0	-.254	.250	-.001	-.011	.424	.117	-.006	.569	1.000
4.4	-.154				.470	.114	-.009	.604	
4.8	-.054				.515	.110	-.011	.638	
5.2	.046				.558	.106	-.012	.670	
5.6	.146				.599	.101	-.013	.701	
6.0	.246				.638	.095	-.014	.731	
6.4	.346				.675	.090	-.015	.758	
6.8	.446				.710	.084	-.015	.785	
7.2	.546				.742	.078	-.015	.809	
7.6	.646				.772	.072	-.015	.831	
8.0	.746				.799	.066	-.015	.852	
8.4	.846				.824	.060	-.014	.871	
8.8	.946				.847	.054	-.014	.888	
9.2	1.046				.868	.049	-.013	.903	
9.6	1.146				.886	.044	-.013	.917	
10.0	1.246				.903	.039	-.012	.930	
10.4	1.346				.917	.034	-.011	.940	
11.2	1.546				.941	.026	-.009	.959	
12.0	1.746				.959	.019	-.007	.972	
12.8	1.946				.972	.014	-.006	.982	
13.6	2.146				.982	.010	-.004	.989	
14.4	2.346				.988	.007	-.003	.994	
15.2	2.546				.992	.004	-.002	.997	
16.0	2.746				.995	.003	-.002	.999	
16.8	2.946				.997	.001	-.001	1.000	
17.6	3.146				.998	.001	.000	1.000	
18.4	3.346				.998	.001	.000	1.000	
19.2	3.546				.999	.000	.000	1.000	
20.0	3.746				.999	.000	.000	1.000	
20.8	3.946				.999	.000	.000	1.000	

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(45) $T_\infty/T_W = 4$; Eu = 1; $f_W = -1.0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.715$; $\frac{\delta_1\sqrt{Re}}{x} = 3.186$; $\frac{\delta_c\sqrt{Re}}{x} = 4.101$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	-1.000	0	0.246	-0.127	0	0.062	0.034	0	0
.2	-.995	.047	.220	-.133	.013	.068	.035	.048	.187
.4	-.982	.088	.193	-.135	.027	.075	.036	.095	.352
.6	-.960	.124	.166	-.133	.043	.083	.036	.140	.496
.8	-.932	.155	.140	-.127	.060	.090	.035	.183	.619
1.0	-.899	.180	.116	-.119	.079	.097	.034	.223	.722
1.2	-.861	.201	.093	-.108	.099	.103	.031	.261	.805
1.4	-.819	.218	.072	-.097	.120	.109	.029	.296	.871
1.6	-.774	.230	.054	-.086	.143	.115	.026	.329	.921
1.8	-.727	.239	.038	-.075	.166	.120	.022	.359	.958
2.0	-.678	.246	.024	-.065	.190	.124	.019	.386	.982
2.2	-.629	.249	.012	-.056	.215	.127	.015	.410	.996
2.4	-.579	.250	.001	-.048	.241	.130	.012	.431	1.000
2.6	-.529	.250	-.008	-.042	.267	.132	.009	.451	
2.8	-.479				.294	.133	.005	.470	
3.2	-.379				.348	.134	.000	.511	
3.6	-.279				.401	.133	-.005	.551	
4.0	-.179				.454	.130	-.009	.590	
4.4	-.079				.505	.126	-.012	.629	
4.8	.021				.555	.121	-.015	.666	
5.2	.121				.602	.114	-.017	.701	
5.6	.221				.646	.107	-.018	.735	
6.0	.321				.688	.100	-.019	.766	
6.4	.421				.726	.092	-.019	.794	
6.8	.521				.761	.084	-.020	.821	
7.2	.621				.794	.077	-.019	.845	
7.6	.721				.823	.069	-.019	.867	
8.0	.821				.849	.062	-.018	.887	
8.4	.921				.872	.055	-.017	.904	
8.8	1.021				.893	.048	-.016	.919	
9.2	1.121				.911	.042	-.015	.933	
9.6	1.221				.926	.036	-.014	.945	
10.0	1.321				.940	.031	-.012	.955	
10.4	1.421				.951	.026	-.011	.963	
10.8	1.521				.961	.022	-.010	.971	
11.2	1.621				.969	.018	-.009	.977	
11.6	1.721				.975	.015	-.008	.982	
12.0	1.821				.981	.012	-.006	.986	
12.4	1.921				.985	.010	-.005	.989	
12.8	2.021				.989	.008	-.004	.992	
13.6	2.221				.994	.005	-.003	.995	
14.4	2.421				.997	.003	-.002	.998	
15.2	2.621				.999	.002	-.001	.999	
16.0	2.821				1.000	.001	-.001	1.000	
16.8	3.021				1.000	.000	.000	1.000	
17.6	3.221				1.000	.000	.000		
18.4	3.421				1.000	.000	.000		

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(46) $T_\infty/T_w = 1/2$; Eu = -0.060; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 3.043$; $\frac{\delta_1\sqrt{Re}}{x} = 0.441$; $\frac{\delta_c\sqrt{Re}}{x} = 0.348$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0	0.121	0	0.206	0.018	0	0
.1	.000	.001	.012	.126	.021	.208	.019	.001	.000
.2	.000	.002	.025	.132	.042	.210	.019	.002	.001
.3	.000	.006	.039	.139	.063	.212	.020	.006	.003
.4	.001	.010	.053	.146	.084	.214	.020	.010	.005
.5	.003	.016	.068	.153	.106	.216	.021	.015	.008
.6	.005	.024	.084	.161	.128	.218	.021	.022	.012
.7	.007	.033	.100	.170	.150	.220	.022	.031	.017
.8	.011	.044	.118	.178	.172	.223	.022	.040	.022
.9	.016	.057	.136	.188	.194	.225	.023	.051	.028
1.0	.023	.071	.155	.198	.217	.227	.023	.064	.036
1.1	.030	.088	.176	.209	.240	.229	.023	.077	.044
1.2	.040	.106	.197	.220	.263	.231	.023	.092	.053
1.3	.052	.127	.219	.231	.286	.234	.023	.109	.064
1.4	.066	.150	.243	.243	.309	.236	.022	.127	.075
1.5	.082	.176	.268	.255	.333	.238	.022	.146	.088
1.6	.101	.204	.294	.267	.357	.240	.021	.167	.102
1.7	.123	.235	.321	.280	.381	.244	.020	.190	.117
1.8	.148	.268	.350	.292	.406	.246	.018	.214	.134
1.9	.177	.305	.330	.303	.431	.248	.016	.239	.152
2.0	.209	.344	.410	.313	.456	.250	.014	.266	.172
2.1	.246	.387	.442	.321	.481	.251	.011	.294	.193
2.2	.286	.433	.475	.327	.506	.252	.007	.323	.216
2.3	.332	.482	.508	.330	.531	.252	.003	.354	.241
2.4	.383	.534	.541	.330	.556	.252	-.002	.386	.267
2.5	.439	.590	.573	.326	.581	.252	-.007	.418	.295
2.6	.501	.649	.606	.315	.607	.251	-.014	.452	.324
2.7	.569	.711	.636	.299	.632	.249	-.021	.486	.355
2.8	.643	.776	.665	.275	.656	.247	-.029	.521	.388
2.9	.724	.844	.691	.243	.681	.243	-.038	.556	.422
3.0	.812	.914	.713	.203	.705	.239	-.047	.592	.457
3.1	.907	.986	.731	.153	.729	.234	-.057	.627	.493
3.2	1.010	1.060	.744	.095	.752	.228	-.068	.662	.530
3.3	1.119	1.135	.750	.029	.774	.220	-.078	.696	.567
3.4	1.236	1.210	.749	-.044	.796	.212	-.089	.728	.605
3.5	1.361	1.284	.741	-.122	.817	.202	-.099	.760	.642
3.6	1.493	1.358	.725	-.202	.836	.192	-.108	.790	.679
3.7	1.633	1.429	.701	-.280	.855	.181	-.116	.818	.715
3.8	1.779	1.498	.669	-.354	.872	.169	-.123	.844	.749
3.9	1.932	1.563	.630	-.419	.889	.156	-.128	.868	.781
4.0	2.092	1.624	.586	-.472	.904	.143	-.131	.890	.812
4.1	2.257	1.680	.536	-.511	.917	.130	-.131	.909	.840
4.2	2.427	1.731	.484	-.534	.930	.117	-.130	.926	.865
4.3	2.603	1.776	.430	-.540	.941	.104	-.127	.941	.888
4.4	2.782	1.817	.376	-.530	.950	.092	-.121	.953	.908
4.5	2.966	1.852	.324	-.506	.959	.080	-.115	.964	.926
4.6	3.153	1.882	.275	-.471	.966	.069	-.106	.972	.941
4.7	3.342	1.907	.230	-.428	.973	.059	-.097	.979	.954
4.8	3.534	1.928	.190	-.381	.978	.049	-.087	.985	.964
4.9	3.728	1.945	.154	-.331	.983	.041	-.078	.989	.973
5.0	3.923	1.959	.124	-.283	.987	.034	-.068	.993	.980
5.1	4.119	1.970	.098	-.236	.990	.028	-.058	.995	.985
5.2	4.317	1.979	.076	-.194	.992	.022	-.049	.997	.989
5.3	4.515	1.985	.059	-.157	.994	.018	-.041	.998	.993
5.4	4.714	1.990	.045	-.125	.996	.014	-.034	.999	.995
5.5	4.913	1.994	.034	-.098	.997	.011	-.027	1.000	.997
5.6	5.113	1.997	.025	-.075	.998	.008	-.022	1.001	.999
5.7	5.312	1.999	.018	-.057	.999	.006	-.018	1.001	1.000
5.8	5.512	2.001	.013	-.044	.999	.005	-.014	1.001	1.000
5.9	5.713	2.002	.010	-.032	1.000	.004	-.011	1.001	1.001
6.0	5.913	2.003	.007	-.024	1.000	.003	-.008	1.001	1.002
6.1	6.113	2.004	.005	-.018	1.000	.002	-.006	1.001	1.002
6.2	6.314	2.004	.003	-.013	1.001	.001	-.004	1.001	1.002
6.3	6.514	2.004	.002	-.009	1.001	.001	-.003	1.001	1.002
6.4	6.714	2.004	.001	-.006	1.001	.001	-.002	1.001	1.002
6.5	6.915	2.004	.001	-.004	1.001	.000	-.001	1.001	1.002
6.6	7.115	2.005	.000	-.003	1.001	.000	-.001	1.001	1.002
6.7	7.316	2.005	.000	-.002	1.001	.000	-.001	1.001	1.002

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(47) $T_\infty/T_w = 1/2$; Eu = -0.04; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 2.309$; $\frac{\delta_1\sqrt{Re}}{x} = 0.406$; $\frac{\delta_c\sqrt{Re}}{x} = 0.420$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.174	0.140	0	0.255	0.028	0	0
.1	.001	.018	.188	.148	.026	.258	.029	.018	.003
.2	.004	.038	.203	.157	.052	.261	.029	.037	.019
.3	.008	.059	.219	.166	.078	.264	.030	.056	.029
.4	.016	.082	.236	.176	.104	.267	.030	.077	.041
.5	.025	.106	.254	.186	.131	.270	.031	.099	.053
.6	.037	.132	.274	.197	.158	.273	.031	.122	.066
.7	.051	.161	.294	.207	.186	.277	.031	.146	.080
.8	.069	.191	.315	.218	.214	.280	.030	.171	.096
.9	.090	.224	.337	.229	.242	.283	.029	.197	.112
1.0	.114	.259	.361	.240	.270	.285	.028	.224	.129
1.1	.142	.296	.386	.251	.299	.288	.026	.252	.148
1.2	.173	.336	.411	.261	.328	.291	.024	.281	.168
1.3	.209	.378	.438	.270	.357	.293	.021	.311	.189
1.4	.249	.423	.465	.278	.387	.295	.017	.341	.212
1.5	.294	.471	.493	.283	.416	.297	.013	.373	.236
1.6	.343	.522	.522	.286	.446	.298	.008	.405	.261
1.7	.398	.575	.550	.286	.476	.298	.002	.438	.288
1.8	.458	.632	.579	.282	.506	.298	-.005	.472	.316
1.9	.524	.691	.606	.272	.535	.297	-.013	.506	.346
2.0	.596	.753	.633	.257	.565	.295	-.022	.540	.377
2.1	.675	.818	.658	.235	.594	.292	-.032	.575	.409
2.2	.760	.884	.680	.206	.623	.289	-.043	.609	.442
2.3	.852	.953	.698	.169	.652	.284	-.055	.643	.477
2.4	.951	1.024	.713	.123	.680	.278	-.067	.676	.512
2.5	1.057	1.096	.723	.070	.708	.270	-.080	.708	.548
2.6	1.170	1.168	.727	.008	.734	.262	-.093	.739	.584
2.7	1.291	1.241	.724	-.060	.760	.252	-.106	.769	.620
2.8	1.418	1.313	.715	-.132	.785	.241	-.119	.798	.656
2.9	1.553	1.384	.698	-.208	.808	.228	-.130	.825	.692
3.0	1.695	1.452	.673	-.281	.830	.215	-.141	.849	.726
3.1	1.843	1.518	.642	-.351	.851	.200	-.149	.872	.759
3.2	1.998	1.580	.604	-.411	.870	.185	-.155	.893	.790
3.3	2.159	1.638	.560	-.461	.888	.169	-.159	.911	.819
3.4	2.326	1.692	.512	-.483	.904	.153	-.160	.927	.846
3.5	2.498	1.741	.462	-.521	.919	.137	-.158	.941	.870
3.6	2.674	1.784	.410	-.524	.932	.121	-.153	.953	.892
3.7	2.854	1.823	.358	-.512	.943	.106	-.146	.963	.911
3.8	3.038	1.856	.308	-.487	.953	.092	-.137	.972	.928
3.9	3.225	1.885	.261	-.453	.962	.079	-.127	.978	.942
4.0	3.415	1.908	.218	-.411	.969	.067	-.115	.984	.954
4.1	3.607	1.928	.179	-.363	.975	.056	-.102	.988	.964
4.2	3.801	1.944	.145	-.314	.981	.046	-.091	.991	.972
4.3	3.996	1.958	.116	-.267	.985	.038	-.079	.994	.979
4.4	4.192	1.968	.092	-.222	.988	.031	-.067	.996	.984
4.5	4.389	1.976	.071	-.182	.991	.024	-.056	.997	.988
4.6	4.587	1.982	.055	-.147	.993	.019	-.046	.998	.991
4.7	4.786	1.987	.042	-.117	.995	.015	-.038	.998	.994
4.8	4.985	1.991	.032	-.090	.996	.012	-.030	.999	.995
4.9	5.184	1.993	.024	-.071	.997	.009	-.024	.999	.997
5.0	5.383	1.995	.017	-.054	.998	.007	-.019	1.000	.998
5.1	5.583	1.997	.012	-.040	.999	.005	-.015	1.000	.998
5.2	5.783	1.998	.009	-.030	.999	.004	-.011	1.000	.999
5.3	5.982	1.999	.006	-.018	1.000	.003	-.008	1.000	.999
5.4	6.182	1.999	.005	-.017	1.000	.002	-.006	1.000	1.000
5.5	6.382	2.000	.003	-.012	1.000	.001	-.004	1.000	1.000
5.6	6.582	2.000	.002	-.008	1.000	.001	-.003	1.000	1.000
5.7	6.782	2.000	.002	-.006	1.000	.001	-.002	1.000	1.000
5.8	6.982	2.000	.001	-.004	1.000	.000	-.001	1.000	1.000
5.9	7.182	2.000	.001	-.003	1.000	.000	-.001	1.000	1.000
6.0	7.382	2.000	.000	-.002	1.000	.000	-.001	1.000	1.000
6.1	7.582	2.000	.000	-.001	1.000	.000	-.001	1.000	1.000
6.2	7.782	2.000	.000	-.001	1.000	.000	-.001	1.000	1.000
6.3	7.982	2.000	.000	-.000	1.000	.000	-.001	1.000	1.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(48) $T_\infty/T_w = 1/2$; $Eu = 0$; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 1.898$; $\frac{\delta_i\sqrt{Re}}{x} = 0.347$; $\frac{\delta_c\sqrt{Re}}{x} = 0.457$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.346	0.136	0	0.290	0.036	0	0
.1	.002	.035	.360	.145	.029	.294	.037	.035	.018
.2	.007	.072	.375	.154	.059	.297	.038	.070	.036
.3	.016	.110	.391	.164	.089	.301	.039	.106	.055
.4	.029	.150	.408	.173	.119	.305	.039	.141	.075
.5	.046	.192	.426	.183	.150	.309	.039	.178	.096
.6	.068	.236	.444	.192	.181	.313	.038	.214	.118
.7	.094	.281	.464	.200	.212	.317	.037	.251	.140
.8	.124	.328	.484	.208	.244	.320	.034	.288	.164
.9	.159	.378	.506	.216	.276	.324	.032	.326	.189
1.0	.200	.429	.527	.221	.309	.327	.028	.363	.215
1.1	.245	.483	.550	.225	.342	.329	.024	.401	.242
1.2	.296	.539	.572	.226	.375	.331	.018	.438	.270
1.3	.353	.598	.595	.225	.408	.333	.011	.476	.299
1.4	.416	.658	.617	.219	.441	.334	.004	.513	.329
1.5	.485	.721	.639	.210	.475	.334	-.006	.550	.361
1.6	.560	.786	.659	.195	.508	.333	-.016	.586	.393
1.7	.642	.853	.677	.174	.541	.331	-.028	.622	.426
1.8	.731	.922	.694	.146	.574	.327	-.041	.657	.461
1.9	.826	.992	.706	.111	.607	.322	-.055	.691	.496
2.0	.929	1.063	.715	.065	.639	.316	-.070	.723	.531
2.1	1.039	1.134	.720	.019	.670	.308	-.086	.754	.567
2.2	1.156	1.206	.719	-.038	.701	.299	-.102	.784	.603
2.3	1.280	1.278	.712	-.101	.730	.288	-.119	.812	.639
2.4	1.411	1.349	.698	-.168	.758	.275	-.134	.837	.674
2.5	1.550	1.418	.678	-.236	.785	.261	-.149	.861	.709
2.6	1.695	1.484	.651	-.304	.810	.246	-.162	.883	.742
2.7	1.846	1.548	.618	-.367	.834	.229	-.173	.902	.774
2.8	2.004	1.607	.578	-.422	.856	.211	-.181	.919	.804
2.9	2.168	1.663	.534	-.466	.876	.193	-.186	.934	.831
3.0	2.337	1.714	.486	-.482	.895	.174	-.187	.947	.857
3.1	2.510	1.760	.436	-.512	.911	.155	-.185	.958	.880
3.2	2.688	1.801	.385	-.510	.926	.137	-.180	.967	.901
3.3	2.870	1.837	.334	-.496	.939	.120	-.171	.975	.919
3.4	3.056	1.868	.286	-.468	.950	.103	-.160	.981	.934
3.5	3.244	1.894	.241	-.431	.959	.088	-.147	.986	.947
3.6	3.435	1.916	.200	-.387	.967	.074	-.132	.989	.958
3.7	3.627	1.935	.164	-.340	.974	.061	-.118	.992	.967
3.8	3.821	1.949	.132	-.292	.980	.050	-.103	.994	.975
3.9	4.017	1.961	.105	-.247	.984	.041	-.088	.996	.981
4.0	4.214	1.971	.083	-.204	.988	.033	-.074	.997	.985
4.1	4.411	1.978	.064	-.167	.991	.026	-.062	.998	.989
4.2	4.609	1.984	.049	-.133	.993	.020	-.051	.998	.992
4.3	4.808	1.988	.037	-.105	.995	.016	-.041	.999	.994
4.4	5.007	1.991	.028	-.082	.996	.012	-.033	.999	.996
4.5	5.206	1.994	.021	-.063	.997	.009	-.026	.999	.997
4.6	5.405	1.995	.015	-.048	.998	.007	-.020	.999	.998
4.7	5.605	1.997	.011	-.036	.999	.005	-.015	1.000	.998
4.8	5.805	1.998	.008	-.027	.999	.004	-.012	1.000	.999
4.9	6.004	1.998	.006	-.020	1.000	.003	-.009	1.000	.999
5.0	6.204	1.999	.004	-.014	1.000	.002	-.006	1.000	.999
5.1	6.404	1.999	.003	-.010	1.000	.001	-.004	1.000	1.000
5.2	6.604	1.999	.002	-.008	1.000	.001	-.003	1.000	1.000
5.3	6.804	2.000	.001	-.005	1.000	.001	-.002	1.000	1.000
5.4	7.004	2.000	.001	-.004	1.000	.000	-.002	1.000	1.000
5.5	7.204	2.000	.001	-.003	1.000	.000	-.001	1.000	1.000
5.6	7.404	2.000	.000	-.002	1.000	.000	-.001	1.000	1.000
5.7	7.604	2.000	.000	-.001	1.000	.000	-.001	1.000	1.000
5.8	7.804	2.000	.000	.000	1.000	.000	-.001	1.000	1.000
5.9	8.004	2.000	.000	.000	1.000	.000	-.001	1.000	1.000
6.0	8.204	2.000	.000	.000	1.000	.000	-.001	1.000	1.000
6.1	8.404	2.000	.000	.000	1.000	.000	-.001	1.000	1.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(49) $T_\infty/T_W = 1/2$; Eu = 0.5; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.980$; $\frac{\delta_1\sqrt{Re}}{x} = 0.116$; $\frac{\delta_c\sqrt{Re}}{x} = 0.460$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	1.275	-0.240	0	0.441	0.083	0	0
.1	.006	.126	1.250	-.260	.045	.450	.086	.124	.063
.2	.025	.250	1.224	-.278	.090	.458	.087	.239	.125
.3	.056	.371	1.195	-.295	.136	.467	.085	.346	.185
.4	.099	.489	1.164	-.312	.183	.475	.079	.444	.244
.5	.154	.604	1.132	-.329	.231	.483	.070	.534	.302
.6	.220	.715	1.099	-.346	.280	.489	.056	.615	.358
.7	.297	.824	1.063	-.364	.329	.494	.037	.688	.412
.8	.384	.928	1.026	-.382	.379	.497	.014	.752	.464
.9	.482	1.029	.986	-.405	.428	.497	-.014	.808	.514
1.0	.590	1.125	.945	-.426	.478	.494	-.047	.856	.563
1.1	.707	1.218	.901	-.449	.527	.487	-.084	.897	.609
1.2	.834	1.305	.855	-.476	.575	.477	-.125	.930	.653
1.3	.968	1.388	.806	-.504	.622	.462	-.169	.956	.694
1.4	1.111	1.466	.754	-.530	.668	.443	-.213	.977	.733
1.5	1.261	1.539	.700	-.559	.711	.420	-.255	.992	.770
1.6	1.419	1.606	.643	-.580	.751	.392	-.294	1.003	.803
1.7	1.582	1.668	.584	-.601	.789	.361	-.326	1.010	.834
1.8	1.752	1.723	.523	-.608	.823	.327	-.350	1.014	.861
1.9	1.927	1.772	.462	-.607	.854	.291	-.363	1.015	.886
2.0	2.106	1.815	.402	-.595	.882	.255	-.364	1.015	.908
2.1	2.290	1.852	.344	-.570	.906	.219	-.355	1.014	.926
2.2	2.476	1.884	.289	-.524	.926	.184	-.334	1.012	.942
2.3	2.666	1.910	.238	-.479	.943	.152	-.306	1.010	.955
2.4	2.858	1.932	.193	-.426	.956	.123	-.272	1.008	.966
2.5	3.052	1.949	.154	-.360	.967	.098	-.235	1.006	.975
2.6	3.248	1.963	.120	-.308	.976	.076	-.198	1.005	.981
2.7	3.445	1.973	.092	-.248	.983	.058	-.162	1.004	.987
2.8	3.643	1.982	.070	-.200	.988	.044	-.130	1.003	.991
2.9	3.841	1.988	.052	-.160	.992	.032	-.101	1.002	.994
3.0	4.040	1.992	.038	-.123	.995	.023	-.078	1.001	.996
3.1	4.240	1.995	.027	-.095	.997	.016	-.057	1.001	.998
3.2	4.439	1.998	.019	-.069	.998	.011	-.042	1.001	.999
3.3	4.639	1.999	.013	-.048	.999	.008	-.030	1.001	1.000
3.4	4.839	2.000	.009	-.032	1.000	.005	-.021	1.001	1.000
3.5	5.039	2.001	.006	-.026	1.000	.003	-.014	1.001	1.000
3.6	5.239	2.002	.004	-.017	1.000	.002	-.010	1.001	1.001
3.7	5.440	2.002	.003	-.011	1.000	.001	-.006	1.000	1.001
3.8	5.640	2.002	.002	-.007	1.000	.001	-.004	1.000	1.001
3.9	5.840	2.002	.001	-.005	1.000	.000	-.002	1.000	1.001
4.0	6.040	2.002	.001	-.003	1.000	.000	-.001	1.000	1.001
4.1	6.240	2.002	.001	-.001	1.000	.000	-.001	1.000	1.001
4.2	6.441	2.003	.000	-.001	1.000	.000	-.000	1.000	1.001
4.3	6.641	2.003	.000	-.000	1.000	.000	-.000	1.000	1.001

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(50) $T_\infty/T_w = 1/2$; Eu = 1.0; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.768$; $\frac{\delta_1\sqrt{Re}}{x} = 0.065$; $\frac{\delta_c\sqrt{Re}}{x} = 0.415$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	1.800	-0.713	0	0.530	0.119	0	0
.1	.009	.176	1.725	-.779	.054	.542	.125	.172	.088
.2	.035	.345	1.645	-.827	.108	.555	.124	.326	.172
.3	.078	.505	1.560	-.860	.164	.567	.116	.464	.253
.4	.136	.657	1.473	-.879	.222	.577	.100	.584	.328
.5	.209	.800	1.384	-.923	.280	.586	.075	.688	.400
.6	.296	.934	1.292	-.889	.339	.592	.041	.775	.467
.7	.395	1.058	1.204	-.881	.398	.594	-.003	.848	.529
.8	.507	1.174	1.116	-.870	.458	.591	-.056	.906	.587
.9	.630	1.282	1.030	-.855	.516	.583	-.118	.951	.641
1.0	.763	1.380	.945	-.845	.574	.568	-.187	.984	.690
1.1	.906	1.471	.862	-.827	.630	.545	-.259	1.008	.735
1.2	1.057	1.553	.780	-.815	.683	.516	-.331	1.022	.776
1.3	1.216	1.627	.699	-.801	.733	.479	-.397	1.031	.813
1.4	1.382	1.693	.619	-.786	.779	.437	-.452	1.034	.846
1.5	1.554	1.751	.542	-.766	.820	.389	-.491	1.033	.875
1.6	1.732	1.801	.466	-.742	.856	.339	-.509	1.030	.900
1.7	1.914	1.844	.394	-.702	.888	.288	-.505	1.025	.922
1.8	2.100	1.880	.326	-.650	.914	.239	-.481	1.021	.940
1.9	2.290	1.909	.264	-.588	.936	.193	-.439	1.016	.955
2.0	2.482	1.933	.209	-.513	.953	.152	-.385	1.012	.966
2.1	2.676	1.951	.161	-.436	.966	.116	-.325	1.008	.976
2.2	2.872	1.966	.122	-.359	.976	.087	-.265	1.006	.983
2.3	3.069	1.976	.090	-.281	.984	.063	-.208	1.004	.988
2.4	3.267	1.984	.065	-.223	.989	.045	-.159	1.003	.992
2.5	3.466	1.989	.045	-.164	.993	.031	-.118	1.002	.995
2.6	3.665	1.993	.031	-.119	.996	.021	-.085	1.001	.996
2.7	3.865	1.996	.021	-.087	.997	.014	-.059	1.000	.998
2.8	4.064	1.997	.014	-.060	.999	.009	-.040	1.000	.999
2.9	4.264	1.998	.009	-.045	.999	.006	-.026	1.000	.999
3.0	4.464	1.999	.005	-.026	1.000	.003	-.017	1.000	1.000
3.1	4.664	2.000	.003	-.017	1.000	.002	-.010	1.000	1.000
3.2	4.864	2.000	.002	-.010	1.000	.001	-.006	1.000	1.000
3 3	5.064	2.000	.001	-.007	1.000	.001	-.003	1.000	1.000
3.4	5.264	2.000	.000	-.003	1.000	.000	-.002	1.000	1.000
3.5	5.464	2.000	.000	-.002	1.000	.000	-.001	1.000	1.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(51) $T_\infty/T_w = 1/4$; Eu = 0; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 2.031$; $\frac{\delta_1\sqrt{Re}}{x} = 0.182$; $\frac{\delta_c\sqrt{Re}}{x} = 0.246$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	0.356	0.208	0	0.288	0.053	0	0
.100	.002	.037	.378	.230	.029	.294	.056	.036	.009
.200	.007	.076	.402	.254	.059	.300	.059	.072	.019
.300	.017	.117	.428	.282	.089	.306	.062	.109	.029
.400	.031	.161	.458	.312	.120	.312	.065	.147	.040
.500	.049	.209	.491	.347	.151	.319	.067	.185	.052
.600	.073	.260	.528	.386	.184	.325	.069	.224	.065
.700	.102	.314	.568	.430	.216	.332	.071	.263	.079
.800	.136	.374	.614	.479	.250	.340	.072	.304	.093
.900	.176	.437	.665	.536	.284	.347	.073	.344	.109
1.000	.224	.507	.721	.599	.319	.354	.072	.385	.127
1.100	.278	.582	.784	.657	.355	.361	.070	.427	.145
1.200	.340	.664	.854	.749	.392	.368	.067	.469	.166
1.300	.411	.753	.934	.838	.429	.375	.062	.511	.188
1.400	.491	.851	1.022	.937	.467	.381	.055	.553	.213
1.500	.582	.958	1.121	1.043	.505	.386	.045	.595	.240
1.600	.683	1.075	1.231	1.155	.544	.390	.032	.637	.269
1.700	.797	1.204	1.352	1.269	.583	.392	.014	.678	.301
1.800	.924	1.346	1.484	1.372	.622	.392	-.008	.720	.337
1.900	1.067	1.502	1.626	1.464	.661	.390	-.036	.757	.375
2.000	1.225	1.672	1.775	1.512	.700	.385	-.071	.794	.418
2.100	1.402	1.857	1.926	1.484	.738	.376	-.112	.829	.464
2.200	1.597	2.056	2.069	1.349	.775	.362	-.160	.861	.514
2.300	1.813	2.270	2.190	1.054	.811	.344	-.213	.890	.567
2.400	2.051	2.493	2.273	.569	.844	.320	-.268	.915	.623
2.500	2.312	2.722	2.296	-.146	.874	.290	-.318	.937	.681
2.600	2.596	2.950	2.240	-.992	.902	.256	-.362	.955	.738
2.650	2.746	3.061	2.179	-1.463	.914	.238	-.376	.962	.765
2.700	2.902	3.168	2.094	-1.928	.926	.219	-.385	.969	.792
2.750	3.063	3.270	1.987	-2.345	.936	.199	-.390	.974	.817
2.800	3.229	3.366	1.861	-2.678	.945	.180	-.388	.979	.842
2.850	3.399	3.456	1.719	-2.985	.954	.161	-.380	.983	.864
2.900	3.574	3.538	1.565	-3.185	.962	.142	-.366	.986	.884
2.950	3.753	3.612	1.403	-3.247	.968	.124	-.347	.989	.903
3.000	3.935	3.678	1.241	-3.257	.974	.107	-.324	.991	.920
3.025	4.028	3.708	1.160	-3.205	.977	.099	-.311	.992	.927
3.050	4.121	3.736	1.080	-3.128	.979	.092	-.297	.993	.934
3.075	4.214	3.762	1.003	-3.058	.981	.084	-.282	.994	.940
3.100	4.309	3.786	.928	-2.990	.983	.078	-.268	.995	.946
3.125	4.404	3.808	.854	-2.851	.985	.071	-.253	.996	.952
3.150	4.499	3.829	.785	-2.730	.987	.065	-.238	.996	.957
3.175	4.595	3.848	.718	-2.586	.988	.059	-.223	.996	.962
3.200	4.692	3.865	.655	-2.458	.990	.054	-.208	.996	.966

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(51) $T_\infty/T_w = 1/4$; $Eu = 0$; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 2.031$; $\frac{\delta_1\sqrt{Re}}{x} = 0.182$; $\frac{\delta_c\sqrt{Re}}{x} = 0.246$ - Concluded

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
3.225	4.788	3.880	0.596	-2.297	0.991	0.049	-0.194	0.997	0.970
3.250	4.886	3.895	.540	-2.154	.992	.044	-.180	.997	.974
3.275	4.983	3.908	.488	-2.007	.993	.040	-.166	.997	.977
3.300	5.081	3.919	.440	-1.861	.994	.036	-.153	.997	.980
3.325	5.179	3.930	.395	-1.717	.995	.032	-.141	.998	.982
3.350	5.277	3.939	.354	-1.581	.996	.029	-.129	.998	.985
3.375	5.376	3.947	.316	-1.446	.996	.026	-.118	.998	.987
3.400	5.475	3.955	.281	-1.308	.997	.023	-.107	.998	.989
3.425	5.574	3.961	.250	-1.198	.997	.020	-.097	.998	.990
3.450	5.673	3.967	.222	-1.090	.998	.018	-.087	.998	.992
3.475	5.772	3.972	.196	-.979	.998	.016	-.079	.998	.993
3.500	5.871	3.977	.172	-.877	.999	.014	-.071	.998	.994
3.525	5.971	3.981	.152	-.785	.999	.012	-.064	.998	.995
3.550	6.070	3.985	.133	-.702	.999	.011	-.057	.998	.996
3.575	6.170	3.988	.116	-.632	.999	.009	-.051	.998	.997
3.600	6.270	3.990	.102	-.558	1.000	.008	-.045	.999	.998
3.625	6.370	3.993	.088	-.492	1.000	.007	-.040	.999	.998
3.650	6.470	3.995	.077	-.439	1.000	.006	-.035	.999	.999
3.675	6.569	3.997	.067	-.382	1.000	.005	-.031	.998	.999
3.700	6.669	3.998	.058	-.339	1.000	.005	-.027	.998	1.000
3.725	6.769	4.000	.050	-.295	1.001	.004	-.024	.998	1.000
3.750	6.869	4.001	.043	-.261	1.001	.003	-.020	.998	1.000
3.775	6.969	4.002	.037	-.225	1.001	.003	-.018	.998	1.000
3.800	7.069	4.003	.032	-.193	1.001	.003	-.016	.999	1.001
3.825	7.170	4.003	.027	-.170	1.001	.002	-.014	.999	1.001
3.850	7.270	4.004	.023	-.149	1.001	.002	-.011	.999	1.001
3.875	7.370	4.004	.020	-.127	1.001	.002	-.010	.999	1.001
3.900	7.470	4.005	.017	-.108	1.001	.001	-.009	.999	1.001
3.925	7.570	4.005	.014	-.092	1.001	.001	-.008	.999	1.001
3.950	7.670	4.006	.012	-.080	1.001	.001	-.007	.999	1.001
3.975	7.770	4.006	.010	-.069	1.001	.001	-.005	1.000	1.002
4.000	7.870	4.006	.008	-.064	1.001	.001	-.004	1.000	1.002
4.050	8.071	4.007	.006	-.044	1.001	.000	-.003	1.000	1.002
4.100	8.271	4.007	.004	-.033	1.001	.000	-.001	1.000	1.002
4.150	8.471	4.007	.003	-.019	1.001	.000	-.001	1.000	1.002
4.200	8.672	4.007	.002	-.013	1.001	.000	-.002	1.000	1.002
4.250	8.872	4.007	.001	-.007	1.001	.000	-.002	1.000	1.002
4.300	9.072	4.007	.001	-.013	1.001	.000	-.003	1.000	1.002
4.350	9.273	4.007	.000	-.005	1.001	.000	-.000	1.000	1.002
4.400	9.473	4.007	.000	-.004	1.001	.000	-.000	1.000	1.002
4.450	9.674	4.007	.000	-.001	1.001	.000	-.000	1.000	1.002
4.500	9.874	4.007	.000	-.001	1.001	.000	-.000	1.000	1.002
4.550	10.074	4.007	.000	-.000	1.001	.000	-.001	1.000	1.002

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Continued

(52) $T_\infty/T_w = 1/4$; Eu = 0.5; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 1.033$; $\frac{\delta_1\sqrt{Re}}{x} = -0.030$; $\frac{\delta_c\sqrt{Re}}{x} = 0.271$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	1.930	-0.124	0	0.480	0.147	0	0
.100	.010	.192	1.917	-.125	.048	.495	.160	.185	.048
.200	.038	.384	1.905	-.116	.099	.512	.170	.355	.096
.300	.086	.574	1.895	-.096	.151	.529	.175	.508	.143
.400	.153	.762	1.886	-.064	.205	.547	.176	.645	.191
.500	.239	.951	1.882	-.017	.261	.564	.171	.765	.238
.600	.343	1.139	1.884	.047	.318	.581	.157	.868	.285
.700	.467	1.328	1.893	.137	.377	.595	.133	.953	.332
.800	.609	1.518	1.911	.235	.437	.607	.097	1.021	.380
.900	.770	1.710	1.940	.355	.498	.614	.046	1.072	.428
1.000	.951	1.906	1.982	.482	.560	.615	-.024	1.106	.477
1.100	1.152	2.107	2.037	.604	.621	.609	-.114	1.126	.527
1.200	1.373	2.314	2.101	.671	.681	.592	-.227	1.132	.578
1.250	1.491	2.419	2.135	.674	.710	.579	-.291	1.131	.605
1.300	1.615	2.527	2.168	.627	.739	.563	-.361	1.127	.632
1.350	1.744	2.636	2.197	.522	.766	.543	-.433	1.121	.659
1.400	1.878	2.746	2.219	.338	.793	.519	-.506	1.113	.687
1.450	2.018	2.858	2.229	.076	.818	.492	-.577	1.104	.714
1.500	2.164	2.969	2.224	-.282	.842	.462	-.644	1.093	.742
1.550	2.316	3.079	2.199	-.756	.864	.428	-.705	1.083	.770
1.600	2.472	3.188	2.148	-1.288	.885	.391	-.751	1.072	.797
1.650	2.634	3.293	2.069	-1.909	.903	.353	-.784	1.062	.823
1.700	2.802	3.394	1.958	-2.515	.920	.313	-.796	1.052	.848
1.750	2.974	3.488	1.818	-3.087	.935	.274	-.789	1.043	.872
1.800	3.151	3.574	1.651	-3.522	.947	.235	-.760	1.034	.894
1.850	3.331	3.652	1.468	-3.800	.958	.198	-.712	1.027	.913
1.900	3.516	3.720	1.275	-3.857	.967	.164	-.647	1.022	.930
1.950	3.704	3.779	1.084	-3.766	.975	.133	-.575	1.016	.945
2.000	3.894	3.828	.901	-3.554	.981	.107	-.496	1.012	.957
2.025	3.990	3.849	.814	-3.352	.983	.095	-.457	1.011	.962
2.050	4.087	3.869	.733	-3.183	.985	.084	-.419	1.009	.967
2.075	4.184	3.886	.655	-3.052	.987	.074	-.381	1.008	.972
2.100	4.281	3.901	.582	-2.769	.989	.065	-.344	1.007	.975
2.125	4.379	3.915	.516	-2.547	.991	.056	-.310	1.006	.979
2.150	4.477	3.927	.454	-2.375	.992	.049	-.278	1.004	.982
2.175	4.576	3.937	.398	-2.109	.993	.043	-.247	1.004	.984
2.200	4.674	3.946	.348	-1.949	.994	.037	-.219	1.003	.987
2.225	4.773	3.954	.301	-1.701	.995	.032	-.193	1.003	.989
2.250	4.872	3.961	.262	-1.508	.996	.027	-.170	1.002	.990
2.275	4.972	3.967	.226	-1.327	.997	.023	-.148	1.002	.992
2.300	5.071	3.972	.195	-1.164	.997	.020	-.129	1.001	.993
2.325	5.171	3.976	.168	-1.007	.998	.017	-.111	1.001	.994
2.350	5.270	3.980	.144	-.883	.998	.014	-.096	1.001	.995
2.375	5.370	3.983	.123	-.796	.998	.012	-.082	1.001	.996
2.400	5.470	3.986	.104	-.716	.999	.010	-.070	1.000	.996
2.425	5.570	3.988	.088	-.592	.999	.008	-.060	1.000	.997
2.450	5.669	3.990	.074	-.515	.999	.007	-.051	1.000	.998
2.475	5.769	3.992	.062	-.426	.999	.006	-.043	1.000	.998
2.500	5.869	3.993	.053	-.355	.999	.005	-.036	1.000	.998
2.525	5.969	3.994	.045	-.304	1.000	.004	-.030	1.000	.999
2.550	6.069	3.995	.038	-.250	1.000	.003	-.025	1.000	.999
2.575	6.169	3.996	.032	-.205	1.000	.003	-.021	1.000	.999
2.600	6.269	3.996	.027	-.168	1.000	.002	-.017	1.000	.999
2.625	6.369	3.997	.024	-.138	1.000	.002	-.014	1.000	.999
2.650	6.469	3.997	.020	-.134	1.000	.001	-.012	1.000	.999
2.675	6.569	3.998	.016	-.084	1.000	.001	-.010	1.000	.999
2.700	6.669	3.998	.013	-.070	1.000	.001	-.008	1.000	.999
2.725	6.769	3.998	.011	-.057	1.000	.001	-.006	1.000	1.000
2.750	6.869	3.998	.009	-.046	1.000	.001	-.005	1.000	1.000
2.775	6.969	3.998	.008	-.038	1.000	.000	-.004	1.000	1.000
2.800	7.069	3.998	.007	-.029	1.000	.000	-.003	1.000	1.000
2.825	7.169	3.999	.006	-.024	1.000	.000	-.003	1.000	1.000
2.850	7.269	3.999	.005	-.020	1.000	.000	-.002	1.000	1.000
2.900	7.469	3.999	.003	-.011	1.000	.000	-.001	1.000	1.000
2.950	7.669	3.999	.002	-.007	1.000	.000	-.001	1.000	1.000
3.000	7.869	4.000	.002	-.004	1.000	.000	.000	1.000	1.000
3.050	8.069	4.000	.002	-.002	1.000	.000	.000	1.000	1.000
3.100	8.269	4.000	.002	.000	1.000	.000	.000	1.000	1.000

TABLE I - VELOCITY, WEIGHT-FLOW, AND TEMPERATURE DISTRIBUTIONS IN LAMINAR BOUNDARY LAYER WITH VARIABLE FLUID PROPERTIES, PRESSURE GRADIENT IN MAIN STREAM, AND FLOW THROUGH POROUS WALL - Concluded

(53) $T_\infty/T_w = 1/4$; $Eu = 1.0$; $f_w = 0$

$\frac{\delta^*\sqrt{Re}}{x} = 0.820$; $\frac{\delta_1\sqrt{Re}}{x} = -0.064$; $\frac{\delta_2\sqrt{Re}}{x} = 0.246$

η	f	f'	f''	f'''	θ	θ'	θ''	u/U_∞	$\frac{\rho u}{\rho_\infty U_\infty}$
0	0	0	2.784	-0.723	0	0.581	0.215	0	0
.1000	.014	.275	2.707	-.806	.059	.604	.237	.262	.069
.2000	.055	.541	2.624	-.842	.121	.628	.251	.492	.135
.3000	.122	.800	2.540	-.826	.185	.654	.255	.689	.200
.4000	.214	1.050	2.461	-.759	.251	.679	.245	.852	.262
.5000	.331	1.292	2.390	-.646	.320	.702	.218	.982	.323
.6000	.472	1.528	2.334	-.467	.392	.722	.170	1.079	.382
.7000	.637	1.760	2.298	-.249	.465	.735	.094	1.146	.440
.8000	.824	1.988	2.286	.038	.538	.739	-.015	1.186	.497
.9000	1.035	2.218	2.305	.310	.612	.731	-.165	1.200	.554
1.0000	1.268	2.450	2.347	.515	.684	.705	-.356	1.193	.612
1.1000	1.525	2.687	2.400	.498	.752	.659	-.582	1.171	.672
1.1500	1.662	2.808	2.421	.313	.785	.626	-.703	1.155	.702
1.2000	1.806	2.929	2.429	.000	.815	.588	-.819	1.138	.732
1.2500	1.955	3.050	2.417	-.528	.843	.545	-.930	1.121	.763
1.3000	2.110	3.170	2.374	-1.204	.869	.496	-1.020	1.103	.793
1.3500	2.272	3.287	2.294	-2.020	.893	.443	-1.084	1.086	.822
1.4000	2.439	3.399	2.171	-2.936	.914	.388	-1.116	1.070	.850
1.4500	2.612	3.503	2.002	-3.769	.932	.332	-1.106	1.056	.876
1.5000	2.789	3.598	1.797	-4.430	.947	.278	-1.058	1.043	.900
1.5500	2.971	3.682	1.565	-4.776	.959	.227	-.974	1.032	.920
1.6000	3.157	3.754	1.322	-4.939	.970	.181	-.865	1.024	.938
1.6250	3.252	3.785	1.199	-4.855	.974	.160	-.804	1.020	.946
1.6500	3.346	3.814	1.079	-4.693	.978	.140	-.739	1.018	.954
1.6750	3.442	3.839	.965	-4.461	.981	.123	-.675	1.015	.960
1.7000	3.538	3.862	.858	-4.081	.984	.107	-.611	1.013	.966
1.7250	3.635	3.882	.759	-3.862	.986	.092	-.549	1.011	.970
1.7500	3.733	3.900	.664	-3.697	.988	.079	-.489	1.009	.975
1.7750	3.830	3.915	.576	-3.278	.990	.068	-.433	1.008	.979
1.8000	3.928	3.928	.499	-2.957	.992	.057	-.379	1.007	.982
1.8250	4.027	3.940	.429	-2.680	.993	.049	-.332	1.005	.985
1.8500	4.126	3.950	.366	-2.305	.994	.041	-.286	1.004	.987
1.8625	4.175	3.954	.338	-2.275	.995	.037	-.267	1.004	.988
1.8750	4.224	3.958	.310	-2.100	.995	.034	-.249	1.004	.990
1.8875	4.274	3.962	.285	-1.926	.995	.031	-.230	1.004	.990
1.9000	4.324	3.965	.262	-1.811	.996	.029	-.213	1.004	.991
1.9125	4.373	3.968	.240	-1.673	.996	.026	-.195	1.003	.992
1.9250	4.423	3.971	.220	-1.519	.997	.024	-.179	1.003	.993
1.9375	4.472	3.973	.201	-1.438	.997	.021	-.165	1.003	.993
1.9500	4.522	3.976	.184	-1.320	.997	.019	-.151	1.003	.994
1.9625	4.572	3.978	.168	-1.210	.997	.018	-.139	1.003	.994
1.9750	4.622	3.980	.154	-1.145	.997	.016	-.128	1.002	.995
1.9875	4.672	3.982	.140	-1.010	.998	.014	-.116	1.002	.995
2.0000	4.721	3.983	.128	-.886	.998	.013	-.106	1.002	.996
2.0125	4.771	3.984	.118	-.833	.998	.012	-.098	1.002	.996
2.0250	4.821	3.986	.108	-.744	.998	.011	-.089	1.002	.996
2.0375	4.871	3.987	.099	-.667	.998	.010	-.081	1.002	.997
2.0500	4.921	3.988	.091	-.718	.999	.009	-.073	1.001	.997
2.0625	4.971	3.989	.082	-.635	.999	.008	-.068	1.001	.997
2.0750	5.021	3.990	.075	-.563	.999	.007	-.061	1.000	.998
2.0875	5.070	3.991	.068	-.506	.999	.006	-.055	1.000	.998
2.1000	5.120	3.992	.062	-.444	.999	.006	-.050	1.000	.998
2.1125	5.170	3.992	.057	-.398	.999	.005	-.045	1.000	.998
2.1250	5.220	3.993	.052	-.359	.999	.004	-.040	1.000	.998
2.1375	5.270	3.994	.048	-.315	.999	.004	-.037	1.000	.998
2.1500	5.320	3.994	.044	-.278	.999	.004	-.033	1.000	.998
2.1625	5.370	3.994	.041	-.248	.999	.003	-.030	1.000	.999
2.1750	5.420	3.995	.038	-.223	.999	.003	-.026	1.000	.999
2.1875	5.470	3.995	.024	-.200	.999	.002	-.023	1.000	.999
2.2000	5.520	3.996	.020	-.174	.999	.002	-.021	1.000	.999
2.2125	5.570	3.996	.017	-.150	.999	.002	-.019	1.000	.999
2.2250	5.620	3.996	.014	-.132	.999	.002	-.018	1.000	.999
2.2500	5.720	3.997	.011	-.104	.999	.001	-.014	1.000	.999
2.2750	5.820	3.997	.008	-.085	.999	.001	-.010	1.000	.999
2.3000	5.920	3.998	.006	-.060	.999	.001	-.008	1.000	.999
2.3250	6.020	3.998	.005	-.045	.999	.001	-.006	1.000	1.000
2.3500	6.120	3.998	.004	-.036	.999	.000	-.004	1.000	1.000
2.3750	6.220	3.999	.003	-.032	.999	.000	-.002	1.000	1.000
2.4000	6.320	3.999	.002	-.016	.999	.000	-.002	1.000	1.000
2.4250	6.420	4.000	.002	-.006	.999	.000	-.002	1.000	1.000
2.4500	6.520	4.000	.002	.002	.999	.000	-.002	1.000	1.000

TABLE II - SUMMARY OF HEAT-TRANSFER AND FRICTION PARAMETERS AND BOUNDARY-LAYER THICKNESSES

f_w	$\frac{T_\infty}{T_w}$	Eu	$\frac{Nu}{\sqrt{Re}}$ θ'_w	$\frac{C_f}{2}\sqrt{Re}$ f_w''	$\delta^*\frac{\sqrt{Re}}{x}$	$\delta_1\frac{\sqrt{Re}}{x}$	$\delta_0\frac{\sqrt{Re}}{x}$
0	1	-0.0904	0.1982	0	3.498	0.868	0.626
		-.0868	.2214	.0580	2.972	.853	.693
		-.0826	.2310	.0870	2.762	.838	.720
		-.0741	.2435	.1296	2.510	.812	.752
		-.0654	.2528	.1637	2.336	.788	.773
		-.0476	.2673	.2202	2.092	.746	.801
		.00	.2926	.3320	1.721	.662	.834
		.50	.4162	.8997	.855	.374	.792
		1.00	.4958	1.2326	.648	.290	.708
	2	-0.1178	0.1890	0	4.582	1.664	1.076
		-.09	.2522	.1634	2.430	1.501	1.408
		-.05	.2756	.2434	1.882	1.383	1.478
		.00	.2944	.3125	1.537	1.271	1.495
		.50	.4002	.6794	.699	.899	1.370
		1.00	.4726	.8987	.515	.763	1.215
	4	-0.1351	0.1794	0	6.950	3.109	1.834
		-.09	.2642	.1934	2.297	2.719	2.595
		-.05	.2790	.2397	1.810	2.582	2.651
		.00	.2952	.2874	1.428	2.457	2.663
		.50	.3876	.5367	.588	1.887	2.344
		1.00	.4530	.6854	.427	1.615	2.075
$-\frac{1}{2}$	1	-0.0418	0.1029	0	4.272	0.954	0.807
		.00	.1662	.1648	2.459	.827	.973
		.50	.2594	.6974	1.033	.444	.994
		1.00	.2934	.9692	.783	.345	.918
	2	0	0.1602	0.1476	2.381	1.605	1.778
		.50	.2290	.4733	.877	1.117	1.760
		1.00	.2526	.6344	.637	.968	1.613
	4	-0.0644	.0796	0	7.219	3.484	2.620
		.00	.1506	.1263	2.460	3.100	3.236
		.50	.2006	.3309	.773	2.486	3.123
		1.00	.2134	.4222	.553	2.235	2.861
-1	1	-0.0072	0.0251	0	6.398	1.116	1.072
		.00	.0516	.0355	4.396	1.073	1.147
		.05	.0880	.1410	2.796	.911	1.241
		.15	.1128	.2703	2.008	.750	1.280
		.50	.1392	.5344	1.252	.524	1.269
		1.00	.1456	.7565	.945	.405	1.208
	2	0	0.0406	0.0242	4.931	2.109	2.167
		.05	.0692	.0892	2.985	1.908	2.299
		.15	.0886	.1678	1.989	1.710	2.343
		.40	.1028	.2866	1.245	1.476	2.320
		.50	.1044	.3205	1.114	1.428	2.289
		1.00	.1024	.4408	.793	1.289	2.206
	4	0	0.0262	0.0125	6.409	4.161	4.002
		.05	.0510	.0542	3.405	3.859	4.248
		.15	.0656	.1030	2.040	3.640	4.309
		.40	.0726	.1705	1.156	3.362	4.266
		.50	.0718	.1882	1.016	3.299	4.254
		1.00	.0616	.2463	.715	3.186	4.101
0	$\frac{1}{2}$	-0.06	0.2064	0	3.043	0.441	0.348
		-0.04	.2554	.1735	2.309	.406	.420
		.00	.2900	.3462	1.898	.347	.457
		.50	.4412	1.2754	.980	.116	.460
		1.00	.5298	1.8000	.768	.065	.415
	$\frac{1}{4}$	0	0.2884	0.3556	2.031	0.182	0.246
		$\frac{1}{2}$	.4801	1.9299	1.033	-.030	.271
		1	.5812	2.7842	.820	-.064	.246

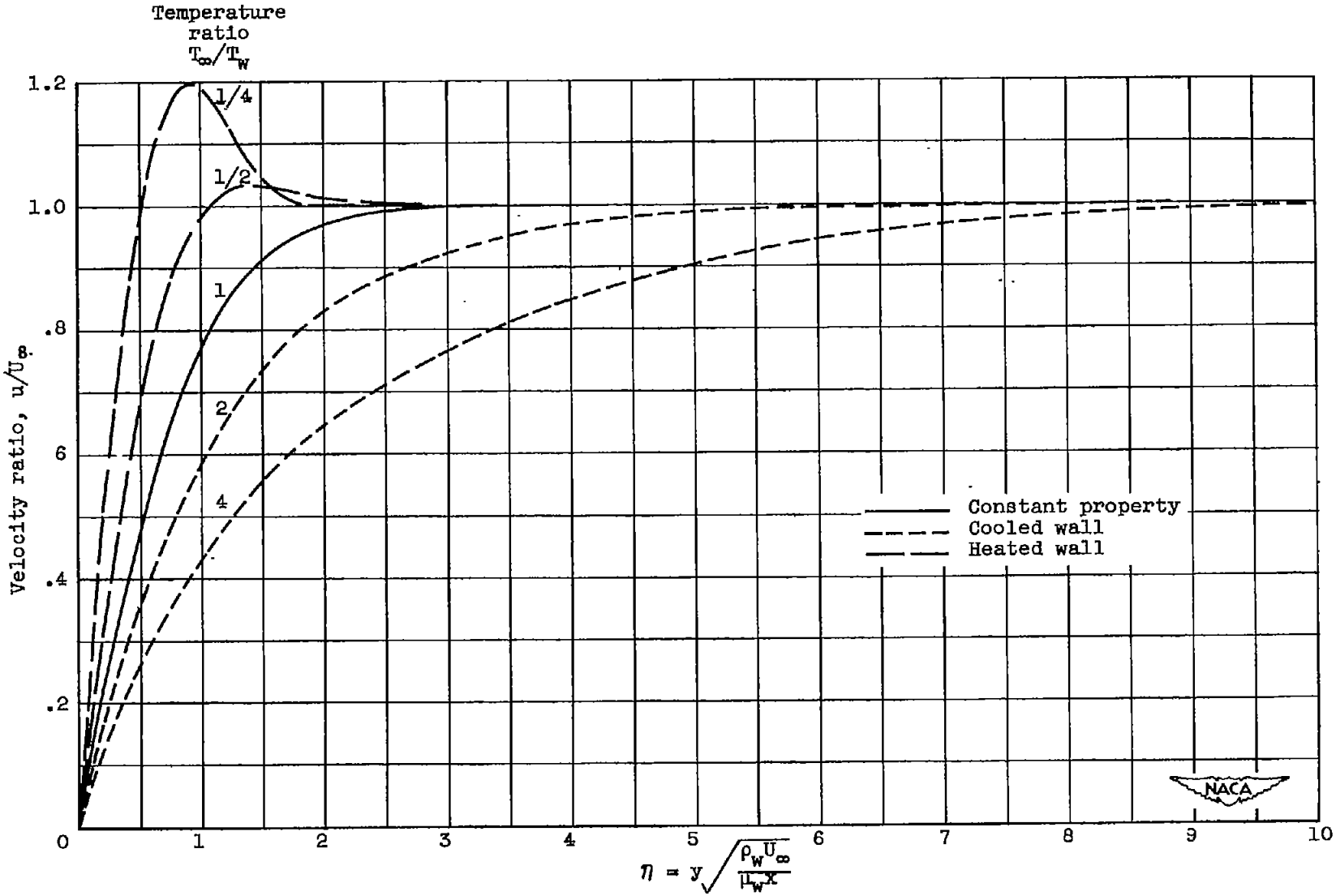

Figure 1. - Velocity distribution in boundary layer for impermeable wall and Euler number of 1.

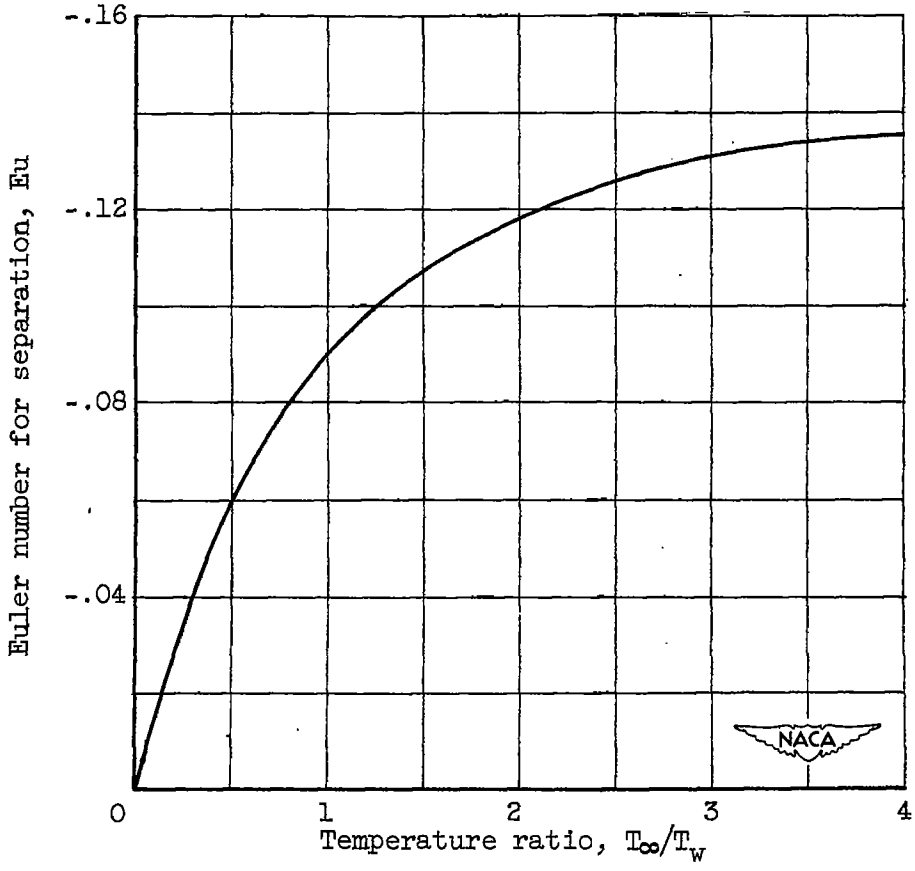

Figure 2. - Values of Euler number for separation from impermeable wall.