Thermal Energy Storage and Regeneration. By Frank W. Schmidt & A. John Willmott. Hemisphere, 1981. 352 pp. $35.50.

This book should be useful to some engineering fluid dynamicists in that it relates to thermal stores and regenerators in which fluid motion is a major consideration. There is no doubt now that the rising cost of energy makes good thermodynamic practice generally, and regenerative systems in particular, increasingly important. The time-dependent behaviour of the interlinked systems discussed in the book is remarkably complicated even though the most primitive models of the fluid mechanics have to be used. The book is very up to date and brings together important practical ideas for the first time. It is of limited interest to persons primarily concerned with fluid mechanics proper, however.

CORRIGENDUM

Axisymmetric Stokes flows due to a rotlet or stokeslet near a hole in plane wall

by A. M. J. Davis, M. E. O'Neill and H. Brenner

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Prof. H. Hasimoto, in a communication to the editor, has pointed out that one of the velocity components in a solution given in the quoted paper, hereinafter referred to as I, becomes infinite as $\rho \to 1-$ at $z = 0$. The function χ constructed in §4 of I can, according to (4.6) and (3.9), be written in cylindrical co-ordinates as

$$\chi = -\frac{2z_0}{\pi}\int_0^\infty e^{-k|z|}J_0(k\rho)\int_1^\infty \frac{s\sin ks}{z_0^2+s^2}\,ds\,dk. \qquad (C\,1)$$

Thus

$$(\chi)_{z=0} = -\frac{2z_0}{\pi}\int_1^\infty \frac{sH(s-\rho)}{z_0^2+s^2}\,ds$$

$$= -\frac{z_0}{(z_0^2+\rho^2)^{\frac{1}{2}}}\left\{1-\frac{2}{\pi}H(1-\rho)\tan^{-1}\left(\frac{1-\rho^2}{z_0^2+\rho^2}\right)^{\frac{1}{2}}\right\},$$

and hence, in (4.4*b*)

$$[v^{(2)}]_{z=0} = (d\chi/\partial\rho)_{z=0} \to \infty \quad \text{as} \quad \rho \to 1-.$$

Hasimoto did a similar calculation for χ in an unpublished lecture note (1979), treating only the case of a stokeslet, and observed that the error arises from using the integrated form of the boundary condition (4.6) for χ on the solid plane. He corrected the error by subtracting from χ the harmonic function

$$\chi_0 = \frac{2z_0\xi}{\pi(z_0^2+1)}(\lambda\tan^{-1}\lambda+1), \qquad (C\,2)$$

where ξ and λ are oblate spheroidal co-ordinates as defined in §5 of I. This function vanishes on the solid plane and gives rise to zero velocity at infinity. Across the hole $z = 0$, $\rho < 1$,

$$\chi_0 = \frac{2z_0\xi}{\pi(z_0^2+1)} = \frac{2z_0(1-\rho^2)^{\frac{1}{2}}}{\pi(z_0^2+1)}, \qquad (C\,3)$$

so that on $z = 0$, $\partial(\chi-\chi_0)/\partial\rho$ is bounded as $\rho \to 1-$. The correct value of the 'reflected velocity' $-V_0\hat{z}$ at the stokeslet is accordingly given by

$$V_0 = \frac{1}{\pi}\left\{\frac{3}{z_0}\tan^{-1}z_0 + \frac{3}{1+z_0^2} - \frac{4}{(1+z_0^2)^2}\right\}. \tag{C 4}$$

It is worth noting that the problem in §4 of I can be solved so as to avoid the singularity in $\partial\chi/\partial\rho$ at the edge of the hole if the differentiated form of (4.6) is used, since all properties of the flow can be determined once $\partial\chi/\partial\rho$ is known. The solution of the boundary-value problem for this function is actually given in §3 of I on identifying $-z_0 w_1$ with $\partial\chi/\partial\rho$. The contribution to V_0 arising from χ is therefore

$$-2z_0^2(w_1/\rho)_{\rho=0,\, z=z_0},$$

which is given by (3.14) of I, and the expression for V_0 is

$$V_0 = \frac{(1-\cos\eta_0)}{2\pi}\left\{\frac{3(\pi-\eta_0)}{\sin\eta_0} + 2\cos\eta_0 + 1\right\}. \tag{C 5}$$

This is the correct form for (4.14) of I and when expressed in terms of z_0 is identical with (C 4). The graph of V_0 plotted against z_0 is displayed in figure 1 and was kindly supplied by Professor Hasimoto, to whom the authors are indebted for bringing to their attention the error in §4 of I.

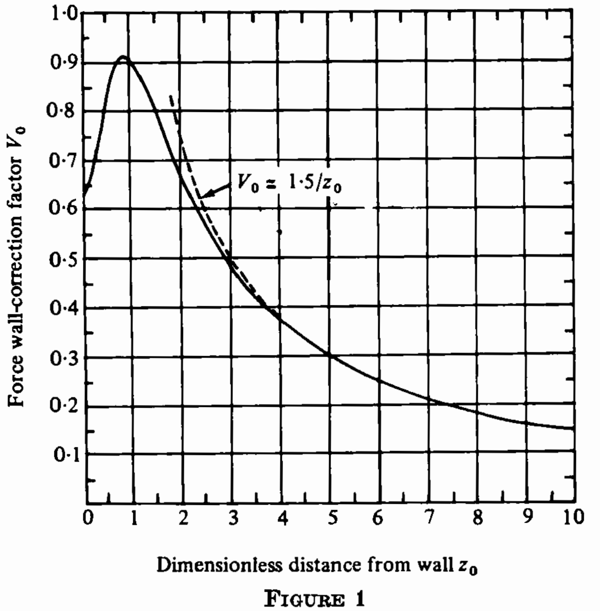

FIGURE 1

REFERENCE

HASIMOTO, H. 1979 Mixed boundary value problems in fluid mechanics. Lecture Note 360, Inst. Math. Sci. Kyoto University.