

Problem 4D.1

Flow near an oscillating wall.⁸ Show, by using Laplace transforms, that the complete solution to the problem stated in Eqs. 4.1-44 to 47 is

$$\frac{v_x}{v_0} = e^{-\sqrt{\omega/2\nu}y} \cos(\omega t - \sqrt{\omega/2\nu}y) - \frac{1}{\pi} \int_0^\infty e^{-\bar{\omega}t} (\sin \sqrt{\bar{\omega}/\nu}y) \frac{\bar{\omega}}{\omega^2 + \bar{\omega}^2} d\bar{\omega} \quad (4D.1-1)$$

⁸H. S. Carslaw and J. C. Jaeger, *Conduction of Heat in Solids*, Oxford University Press, 2nd edition (1959), p. 319, Eq. (8), with $\varepsilon = \frac{1}{2}\pi$ and $\bar{\omega} = \kappa u^2$.