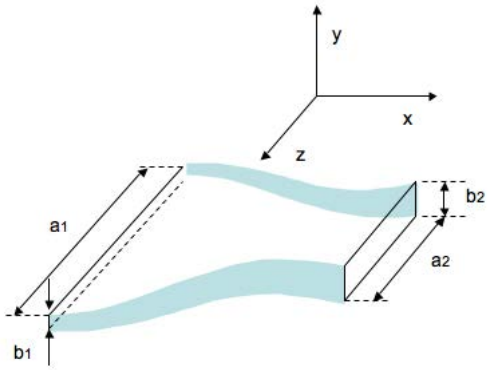
MIT Department of Mechanical Engineering
2.25 Advanced Fluid Mechanics

Problem 10.04
This problem is from "Advanced Fluid Mechanics Problems" by 2.25 Problem Set Solution — Problem



A steady, inviscid, incompressible flow experiences a change of cross sections between stations (1) and (2), as shown. At station (1), the velocity distribution is

$$v_x = U + ky, \qquad -\frac{b_1}{2} < y < \frac{b_1}{2}, \tag{10.04-1}$$

where U is the mean flow velocity. There are no body forces acting on the fluid. Considering U, k, and the system dimensions given, determine expressions for

- (a) the vorticity at station (1),
- (b) the vorticity at station (2),
- (c) the velocity distribution at station (2),
- (d) the ration $\frac{\Delta v_x}{v_x}$ average of the total velocity excursion to the average velocity at (2), divided by the same quantity at (1).

Answer

$$\frac{\Delta v/v_{av}}{\Delta v/v_{av}} = \left(\frac{A_1}{A_1}\right)^2, \tag{10.04-2}$$

where A stands for $a \cdot b$.

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Fall 2013