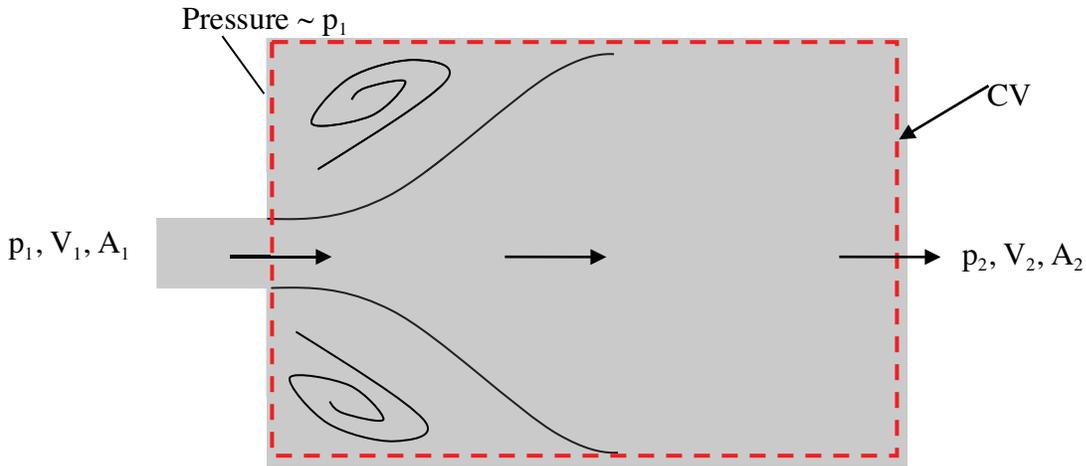


MASSACHUSETTS INSTITUTE OF TECHNOLOGY
 DEPARTMENT OF MECHANICAL ENGINEERING
2.06 Fluid Dynamics
RECITATION #4, Spring Term 2013

Topics: Open Systems

Problem 1 (Flow expansion)

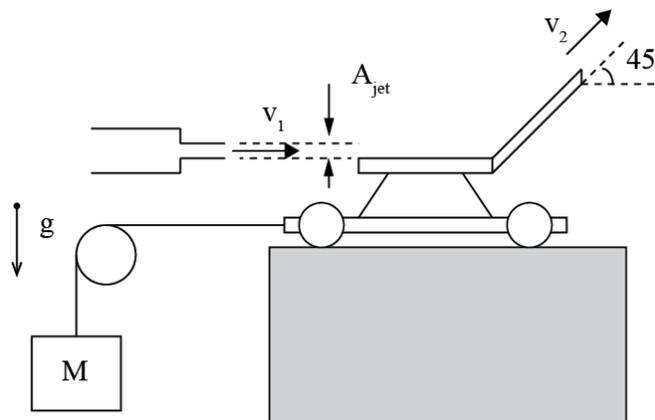


When a pipe flow suddenly expands from A_1 to A_2 , low speed, low-friction eddies appear in the corners and the flow gradually expands to A_2 downstream. Using the suggested control volume for incompressible steady flow and assuming that $p \approx p_1$ on the corner annular ring as shown,

show that the downstream pressure is given by $p_2 = p_1 + \rho V_1^2 \frac{A_1}{A_2} \left(1 - \frac{A_1}{A_2}\right)$. Neglect wall friction.

Problem 2 (Cart)

A cart tied to a mass M hanging over a pulley is kept stationary by an incoming jet of water. The water jet, which has a velocity $v_1 = 15 \text{ m/s}$ and a cross-sectional area $A_{\text{jet}} = 0.05 \text{ m}^2$, is deflected upwards by the cart at an angle of 45° . Calculate the mass M assuming that the flow is steady and frictionless. The density of water is $\rho = 1000 \text{ kg/m}^3$.



MIT OpenCourseWare
<http://ocw.mit.edu>

2.06 Fluid Dynamics
Spring 2013

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.