

Problem 115I

For each of the three flows [A], [B], and [C] described below answer the following questions:

- (1) Find the form of the streamlines and make a sketch illustrating them.
- (2) Find the rate of deformation tensor.
- (3) Find the vorticity.
- (4) Sketch and describe how a small fluid element deforms in each of these flows.

The flows are:

[A] Stagnation point flow given by:

$$(u, v, w) = (kx, -ky, 0)$$

[B] Ideal (potential) vortex flow:

$$(u_r, u_\theta, u_z) = \left(0, -\frac{\Gamma}{2\pi r}, 0\right)$$

[C] Solid body rotation:

$$(u_r, u_\theta, u_z) = (0, \Omega r, 0)$$