November 4, 2019

MANE 6960-01 Fluid Mechanics
Fall Semester 2019
HW #4
Due: November 18, 2019

Problem 1. In an annulus formed between a rod of radius R_0 and a concentric tube with radius R_1, the rod is rotated with an angular velocity Ω while the tube is stationary. The upstream and downstream pressures are the same. Find the expression for the velocity components of the fluid contained within the annulus.

Problem 2. Consider the same geometry as in Problem 1. However, now $\Omega = 0$, and the rod is pulled in the axial direction with a speed $V_x = V_0$. Find the velocity of the fluid while neglecting gravity and assuming that there is no pressure gradient.

Problem 3. Consider the same geometry as in Problem 1. However, now $\Omega = 0$, and a constant pressure gradient $\Delta P/L$ is applied along the axis of the rod. Find the velocity of the fluid while neglecting gravity.

Problem 4. Consider the same geometry as in Problem 1, but now $\Omega \neq 0$, $V_x \neq 0$, and $\Delta P/L \neq 0$. Is the solution to this problem simply the combination of solutions of Problems 1-3? If yes, then why?