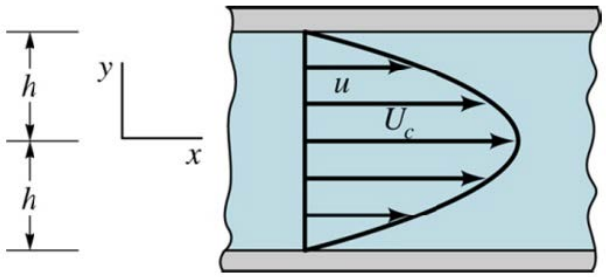
October 31, 2012

NAME

Fluids-ID

Quiz 10. Oil (μ = 0.4 N·s/m^2) flows between two fixed horizontal infinite parallel plates with a spacing of 5 mm. The flow is laminar and steady with a constant pressure gradient dp/dx = -900 N/m^3. Determine the shear stress $\tau_{xy} = \mu(\partial u/\partial y + \partial v/\partial x)$ at $y = h$, by solving Navier Stokes equation.



Continuity: $$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$$

Navier Stokes: $$\rho\left(\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y}\right) = -\frac{dp}{dx} + \mu\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right)$$