Homework problems on Fluid Dynamics
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1. **Jet from a point source of momentum**

Condier a laminar jet formed by fluid forced out of a hole by high pressure. Apply boundary layer approximtion for a jet of high initial momentum flux. Let the momentum source be at $(r = 0, z = 0)$ and the z axis be also the jet axis. Start from the continuity equation

$$\frac{\partial(ur)}{\partial r} + \frac{\partial(wr)}{\partial z} = 0 \tag{1}$$

and the momentum equation

$$u\frac{\partial w}{\partial r} + w\frac{\partial w}{\partial z} = \frac{\nu}{r}\frac{\partial}{\partial r}\left(r\frac{\partial w}{\partial r}\right) \tag{2}$$

Show first that that the momentum flux across the jet is constant in z and is equal to the value M at the source. Express the velocity components and all boundary conditions in terms of a stream function, then solve the problem by the method of similarity. Plot the result and discuss.