Turbulent Jet - Exercises

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Problem Specification
1. Pre-Analysis & Start-Up
2. Laminar Setup and Solution
3. Laminar Results
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Exercises

These additional exercises build on the data from the Laminar and Turbulent Results page. The Matlab Read ASCII script available on the Laminar Results page will be useful in completing them.

Laminar Jet

1. Evaluate and plot the spreading rate of the jet, S = dR(x)(1/2)/dx where R(x)(1/2) is the half width of the laminar jet, computed in the Laminar Jet - Results section. For a jet that spreads linearly, the spreading rate will be constant, although there will be a steep differential and non constant spreading as the jet is initially exposed to the environment.
2. Evaluate and plot the local Reynolds number of the flow, given by R = (U_center)*R(x)(1/2)/. The average local Reynolds number should be independent of x and be approximately 40.

Turbulent Jet

1. Examine the self-similarity of the profiles of the turbulent kinetic energy k, and turbulent dissipation . The scaling factor for the turbulent kinetic energy profile should be 1/(U_center)^2, because kinetic energy depends on the square of velocity. The scaling factor for the turbulent dissipation should be R(x)(1/2)/(U_center)^3, where R(x)(1/2) is the jet half width.
2. Examine the self-similarity of the profiles of the radial velocity (scaled by U_center), the Reynolds stresses (scaled by (U_center)^2)) and the turbulent intensity (normalized by the square of the local axial velocity). Compare these profiles to those in Pope's *Turbulent Flows*, Figures 5.6-5.8.

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