Computer Project #2

Computational Fluid Dynamics, MAE 5440, Spring Semester 2016

Date Due: Friday, March 4, 2016

Consider the convection of a step profile in a uniform incompressible flow oblique to the grid lines as shown in the figure below. If we neglect the effects of diffusion, and set the density to one, then the governing equation becomes:



Let *u=v=*2 and define the domain over the region 0<=*x*<=1 and 0<=*y*<=1.

Implement the deferred correction method as discussed in class to solve the problem. Use 2nd order central interpolation method to represent the “higher order solution.” Obtain solutions for values of the blending factor given by 0.0 (representing pure 1st order upwind), 0.9 (representing a blending), and 1.0 (representing 2nd order central).

In the Results section of your report (following ASME formatting and style) be sure to discuss the effect of grid resolution and blending factor on artificial diffusion. To do this:

1. Compute solutions on 10x10, 20x20, and 40x40 grids (interior volumes), each with blending factors of 0.0, 0.9, and 1.0 (hence 9 sets of results).
2. Present three line plots similar to Fig. 5-15 in your text. Each of the three plots should represent results for one of the three blending factors above. That is, results for the three mesh densities and the exact solution should appear on each plot.
3. Include one more plot based on the fine grid results. The lines on this plot should represent results for the three different blending factors. (Hence a total of 4 plots.)
4. Include a contour plot of the solution distribution for the fine mesh, blending factor of 1.0 case.

