Square Lid Driven Cavity

Engineering Challenge

This classic two dimensional lid-driven cavity test case is documented in literature by Ghia [1]. The fluid motion in the cavity is driven by shear forces due to a moving wall boundary condition at the top of the cavity. Figure 1 details the geometry of the cavity along with the dashed lines D_h and D_v showing where data is taken for comparison. Figure 2 shows the Azore CFD results, depicting contours of total velocity (m/s) with overlaid velocity vectors.

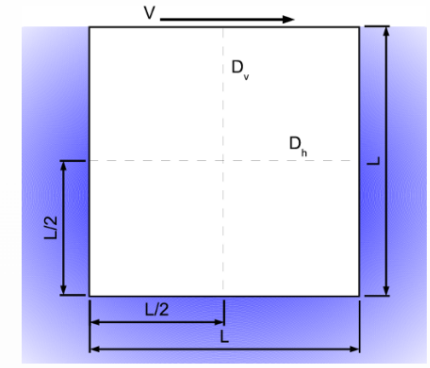

Figure 1

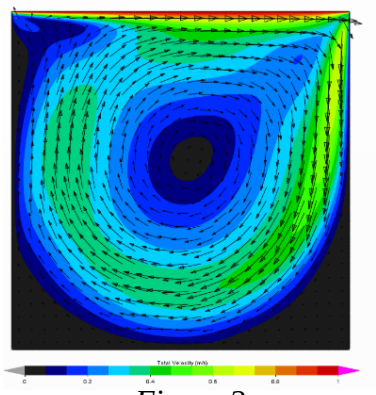

Figure 2

Azore Solution

The Reynolds number of the cavity was used to classify the flow in the square cavity. A systematic grid refinement was employed, via six different, uniformly spaced mesh topologies of square control volume (10x10, 20x20, 40x40, 80x80, 160x160, and 320x320).

Figures 3 and 4 show line graphs of the horizontal velocity predicted by Azore for each mesh density. These results show the accuracy of Azore. A grid independent solution is achieved with the 80x80 mesh density, with only small improvements in solution fidelity as the mesh density is doubled to 160x160 and 320x320.

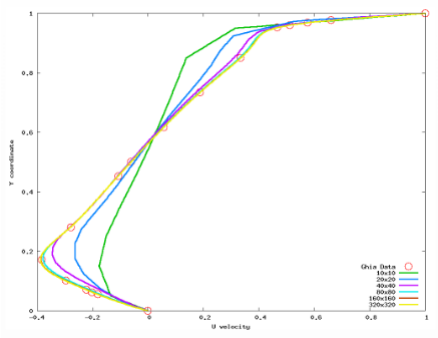

Figure 3

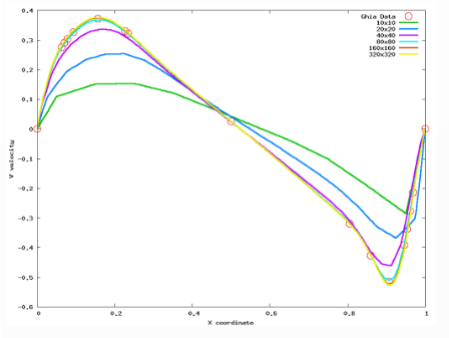

Figure 4

[1] 1. U. Ghia, K.N. Ghia, and C.T. Shin, High-Re solution for incompressible flow using the Navier-Stokes equations and a multigrid method, Journal of Computational Physics 48 (1982), 387–411.