18.086 spring 2008

Bonus Exercise Sheet

Out Wed 03/19/08   Due Wed 04/23/08

Exercise Consider the Matlab program `mit18086_navierstokes.m` from the CSE web page, which solves the incompressible, viscous flow in a lid driven cavity.

1. Extend the program to allow one hole in the geometry. Let the hole be a rectangle, and allow the position and size of the hole to be chosen by the user. Preserve as much as possible of the vectorized structure, and try to create brief code.

2. Allow further to choose inflow and outflow boundaries.

3. Use your program to compute the flow around an obstacle. Let the horizional walls be no-slip walls. On the left wall prescribe a parabolic inflow profile. On the right wall prescribe outflow boundary conditions. All four boundaries of the hole shall be no-slip walls. Initially, the whole fluid shall be at rest.

4. Use your code to show the transition to turbulence by running it for various Reynolds numbers. Produce videos of your simulation.

Rules:

- This problem set is a bonus. It is worth 15 bonus points for your homework score.

- The whole class submits *one* solution. At most one solution. Not more. **One!** Everybody receives the bonus points granted.

- If you make the obstacle a circle, you can get 20 bonus points instead of 15.