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Assignment #6
12/2/09

#Advecting Particles

The file particulate.cpp contains the main() function as well as the particulate() function which propegates the particles position's based on the velocity field and a 4 stage Runge Kutta scheme.

Since a local time step is used for each particle it was necessary to invent a scheme for outputting the particle positions at set times, making it much easier to plot the particles together. For each particle the time since the last timestep is stored (delt[]). If the next update of it's position/time were to cause the delt value to be greater than a sampling timestep the particle is propegated to exactly the sampling timestep value and is set 'ready'. While 'ready' a particle is not propegated until all other particles are set to 'ready', at which point the location and velocity of all the particles are written to a file. This constitutes a single complete timestep. The program is allowed to propegate until all particles have left the bounding box, in this case it took 200 timesteps for this to happen.

You'll notice in the movie that some particles get stuck on the left side of the obstacle, shortly after many dissapear because they have passed through the object. I handle this by removing them from the simulation, of course it would be possible to nudge the particles back out of the obstacle or even hold them in place. It seems that there is no 'correct' way to handle this occurence without some physical meaning for the model itself.

#Results & Plotting

Running './particulate' generates 4 files. 2 contain the coordinates of the particles at each timestep (ptcls_x.dat and ptcls_y.dat). 2 files contain the velocity of each particle and each corresponding timestep (ptcls_vx.dat and ptcls_vy.dat). These are used to generate the images and movies using the matlab scripts movie_particulate.m and plot_particulate.m.

The movie 'particulate.avi' was compiled from plots of the particles at every timestep was generated in a similar way to the movie from assignment 5.
The image particle_stages.jpg shows the particles at 4 different stages as they are advected.

Note that the color of the particles represents the magnitude of their velocity as defined by the colorbar on the right, the scale was artificialy normalized to 1.