Dustin Slade
12/14/12

Kármán Vortex Street Code Analysis

Rho is a matrix with values representing densities between 0 and 1. We start initially with a density along a stretch on the edge of rho. This concentration of density, which is re-added in each iteration of the loop, is what will be advected by the velocity vector-field. The velocity vector-field is provided in the form of u and v component matrices for each step through time. In order to advect the density in rho with the u and v components, I used the following equation:

$$\rho(i,j) = -dt(u(i,j) * drx + v(i,j) * dry) + \rho(i,j)$$

Where *drx* and *dry* are dependent on the value of u and v respectively

To define *drx:*

$$if\ u(i,j) \leq 0:$$
$$drx = (\rho(i+1,j) - \rho(i,j))/dx$$

$$if\ u(i,j) > 0:$$

$$drx = (\rho(i,j) - \rho(i-1,j))/dx$$

To define *dry*:

$$if\ v(i,j) \leq 0:$$

$$dry = (\rho(i,j+1) - \rho(i,j))/dy$$

$$if\ v(i,j) > 0:$$

$$dry = (\rho(i,j) - \rho(i,j-1))/dy$$

A contour plot of the resulting matrix rho can be seen in an included video. The effect produced is called the Kármán Vortex Street effect. This effect can be observed in the real world when clouds are blown around an island.