CDS 301 Spring 2013
Scientific Information and Data Visualization
Project 2

Assignment Date: March 09, 2013
Due Date: March 16, 2013

Visualization of 3-D Scalar and Vector Data

The purpose of this project is to visualize three-dimensional scalar and vector data using a set of MATLAB programs.

The 3-D data you shall explore is MATLAB built-in data, which can be obtained by calling "load wind". The data provide the vector wind speed pattern from the ground to a certain height in the region of northern America. The dimensional sizes of the data are of 34 X 45 X 15. You are asked to explore the wind pattern in the following way

(1) Convert the vector data to the scalar data, show the slices of velocity magnitude at z = 1 and z=10 in the same plot.
(2) Show the contours of scalar velocity at the slices of z=8 and x = 17 in the same plot.
(3) Show the scalar velocity at the slice tilted by 45 degrees from the X-Y plane in a plot
(4) Show the 3-D isosurface of wind speed of 20 and the corresponding isocaps in a plot
(5) Draw streams lines originated from 6 X 6 equally spaced seed points at X=75 plane. Also show the X=75 slice at the same plot.
(6) Draw streams lines originated from 8 X 8 equally spaced seed points at Z=1 plane. Also show the Z=1 slice at the same plot.
(7) Find the location or point of the highest velocity, and draw three orthogonal lines across the point in the 3-D volume.
(8) Find the location or point of the highest vorticity (you need to calculate the vorticity first), and draw three orthogonal lines across the point in the 3-D volume
(9) Make a stream particle animation with the following seeds points: (a) the point with the highest voticity, and (b) six other points equally distributed along the line crossing the highest-vorticity point and in parallel with the Z-axis.
(10) Make a plot with your own preference that can explore the data very well. This shows your creativity and the mastering of visualization techniques.

For every plot that you make, you are responsible for the quality and clarity of the plot with proper annotation of the axis, view angle, color, lighting and any other relevant visual effects. The grading will be largely depending on the overall quality of the plots.

Submission: electronic submission only. You need to submit at least the following files: (1) a project report (in either WORD or PDF format) that contains all plots you make, and a short meaningful description of the rendering method and the result showing in each plot. A short summary in the beginning and the end of the report are needed. (2) The MATLAB program or programs that execute the required tasks. You are free to break the ten required tasks into any number of individual MATLAB program files, but the smaller the number, the better.