

## Assignment 2

### 3D Scalar Data Visualization: Visually Explore Temperature and Pressure Distribution in a Particular Region

In this assignment, you'll perform visual analysis of temperature and pressure inside a particular region. You've been given some temperature (**temperature.dat**) and pressure (**pressure.dat**) data. Both temperature and pressure data are stored in a regular grid of dimension (18, 18, 10). You'll explore global and local distribution of temperature and pressure inside that region. You'll need to do the following in this assignment:

#### Step 1: Data Import:

Import both temperature and pressure data as structured grid points: You'll need to use **vtkStructuredPointsReader** to import temperature and pressure data. After you import the data, it will look like the following (Figure 1). You'll also need to use scale bar to visualize the range of data as shown below. You can use **vtkScalarBarActor** for this.

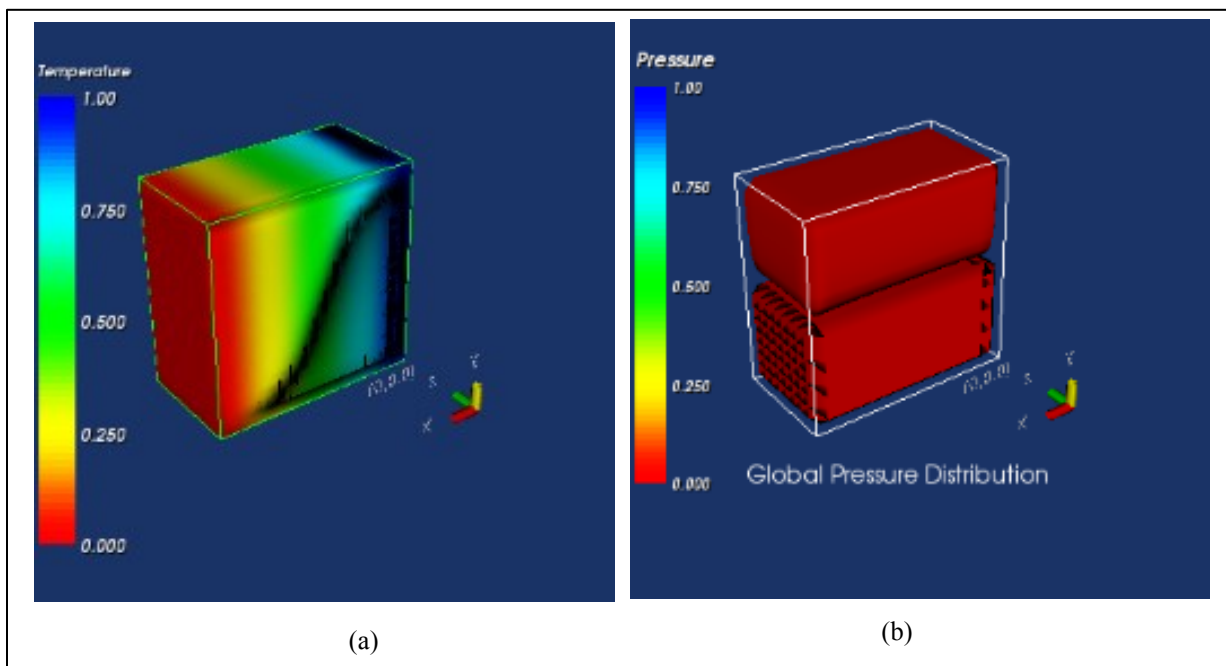


Figure 1: (a) Global temperature distribution and (b) global pressure distribution.

#### Step 2: In –depth Data Analysis:

You need to analyze the data using the following two methods:

- Isosurface extraction and
- Probing method.

- a) **Isosurface extraction:** Extract isosurfaces for different iso values, i.e., 0.1, 0.2, 0.3, 0.5, 0.75 etc. **vtkContourFilter** method can extract iso surfaces for different iso values by using the marching cube algorithm as already discussed in the class. Next, **vtkPolyDataMapper** triangulates the data. Here are some examples of the extracted temperature iso surfaces for different iso values (Figure 2).

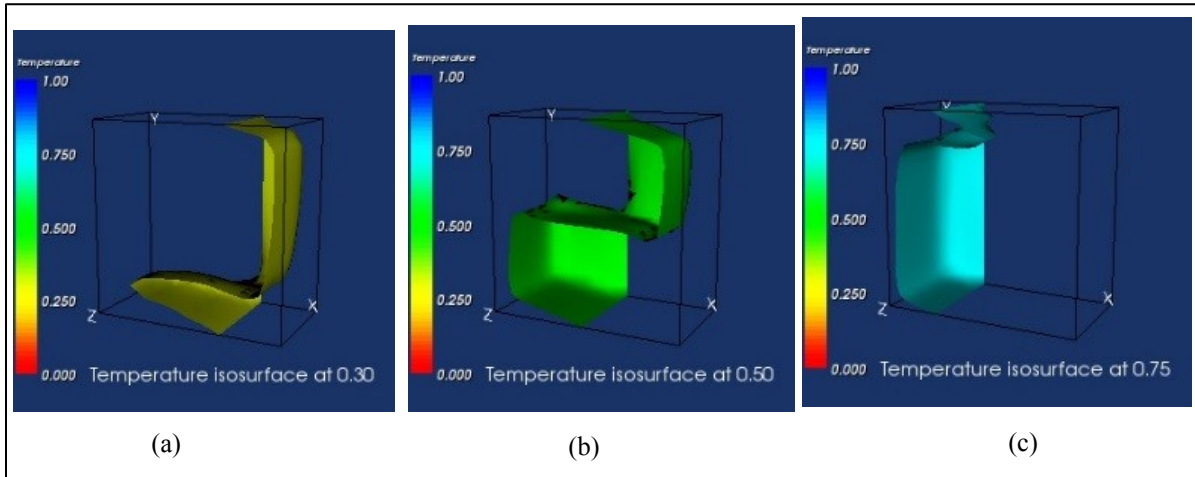


Figure 2: Temperature iso-surfaces for iso-values (a) 0.3, (b) 0.5 and (c) 0.75 respectively.

Similarly, extract isosurfaces for the pressure data. After extracting isosurfaces, analyze and explore temperature and pressure distribution in the region using visual analysis of different iso surfaces for temperature and pressure.

- b) **Probing Method:** Probe the data at regular intervals along X, Y and Z directions. As data dimension is 18X18X10, you need to analyze the data by taking cross sections at regular intervals along X, Y and Z directions. You can use **vtkExtractVOI** to extract a sub-region of the volume. The output from **vtkExtractVOI** is passed to **vtkContourFilter**. Figure 3 demonstrates three examples of using **vtkExtractVOI** for probing data along X, Y and Z directions respectively.

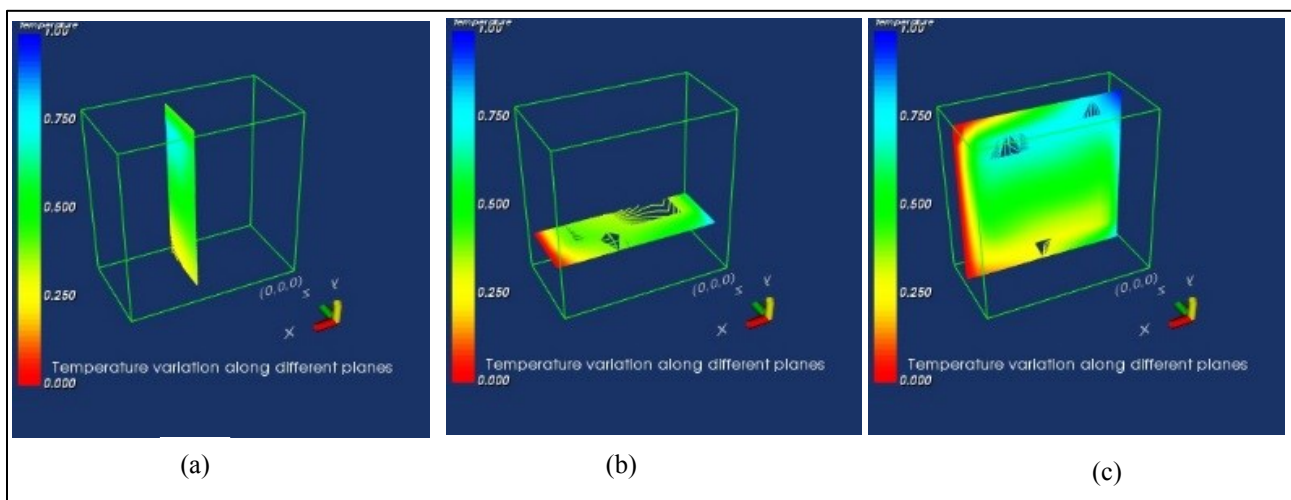


Figure 3: Temperature exploration using probing along (a) X, (b) Y and (c) Z-directions respectively.

Similarly, probe for the pressure data. After extracting a number of X-sections both for temperature and pressure data, analyze the temperature and pressure distribution in the region using visual analysis of the heat map.

**Implementation and Submission:** This is not a group assignment, each student needs to do the assignment. You're expected to do the assignment using VTK. Submit all the necessary codes that you need to write to explore temperature and pressure distribution. Write down your analysis in a pdf file named **ScalarVisualization.pdf**. Submit all vtk codes and pdf file in a zipped file named **LastName\_FirstLetter ofFirstName\_Assignment2.zip**.

Submission deadline is **Thursday, November 9**.

This assignment carries 20% of the course evaluation.

**Acknowledgement:** The instructor is thankful to the University of Leeds, UK and Professor Bahari Belaton of Universiti Sains Malaysia for the data used in this assignment.