University of Stuttgart
Institute for Visualization and Interactive Systems (VIS)

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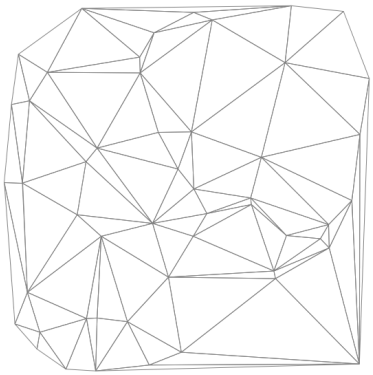
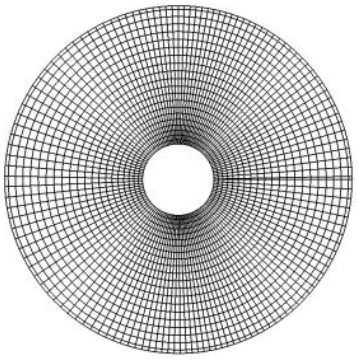
Scientific Visualization (Assignment 4)

Exercise 4. 1 [2 Points] Grid Types I

Classify the following two grids according to their data structure as described in the lecture. Compare the properties of the two grid types.



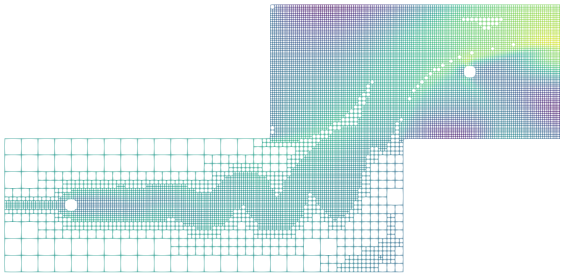
(a)



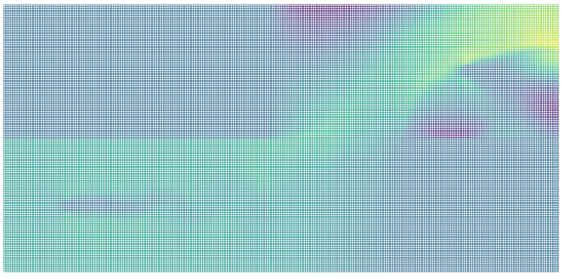
(b)

Exercise 4. 2 [2 Points] Grid Types II

The following two images show the flow around a corner within two cylinders, where (a) shows the original grid used in the simulation. Notice that the form of the grid corresponds to the geometry of the domain. The image in (b) shows the same flow in a resampled cartesian grid. The color indicates the horizontal flow velocity. Discuss advantages and disadvantages of the two grid types.



(a)



(b)

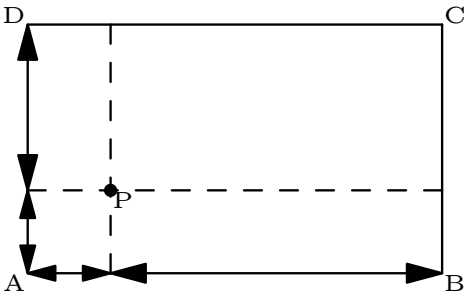
Exercise 4. 3 [1 Points] Voronoi Diagram

Describe the main property of a Voronoi cell with respect to interpolation. Name the geometrical dual of a Voronoi diagram and describe the relation of edges in a Voronoi diagram and its dual.

Exercise 4. 4 [1 Points] Bi-linear Interpolation

Calculate the value at $P = (4, 3.5)$ given the following points and respective values:

$A = (3, 2)$	$B = (7, 2)$	$C = (7, 6)$	$D = (3, 6)$
$f(A) = 0.5$	$f(B) = 0.1$	$f(C) = -0.3$	$f(D) = 0.2$

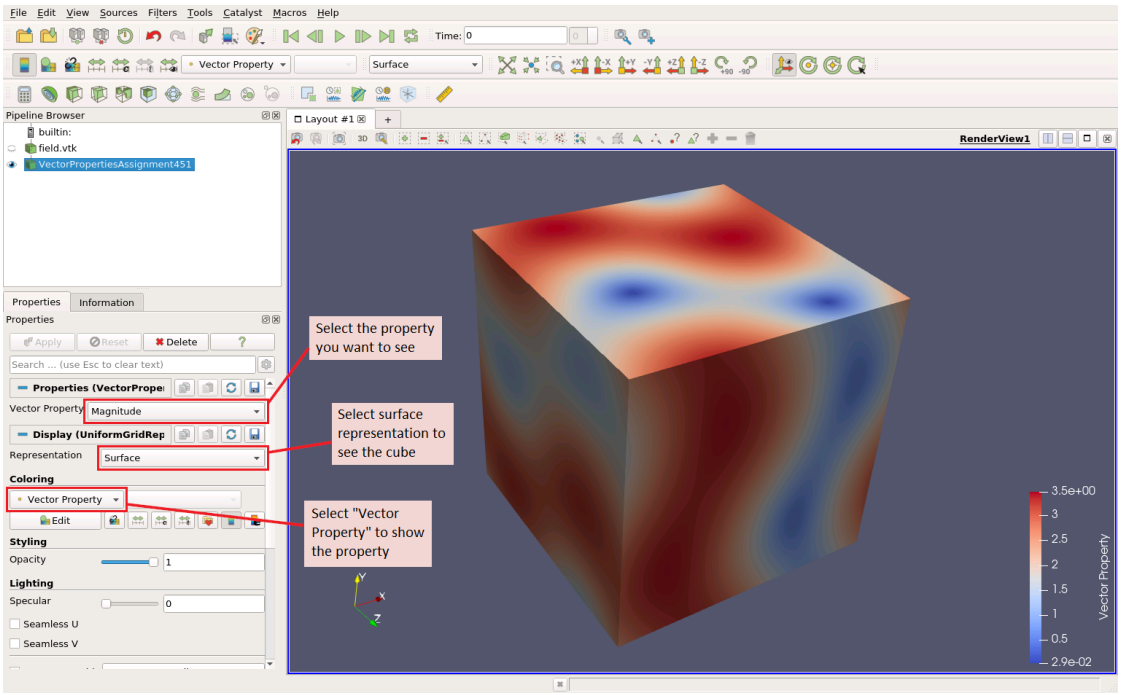


Note that the image is only an illustration and does not exactly match the given values.

Exercise 4. 5 [5 Points] ParaView: Color Mapping

In this exercise, you are going to visualize a 3D velocity field using color mapping. The data file is located in `~/scivis-2020/source/data`. You have to visualize the velocity magnitude, all three directional components of the velocity (u_x, u_y, u_z), and all three components of the velocity vector in spherical coordinates (r, θ, ϕ). You may refer to Wikipedia, if you need to look up the formulas for spherical coordinates.

The code you have to extend is given again in form of a ParaView plugin within a Docker image. All sections where your implementation is required, are marked by a `TODO`. The two source files `exercise_05.h` and `exercise_05.cxx`, as well as the information file for ParaView `scivis_assignment_04.xml`, have to be altered. Detailed instructions are provided as comments in the source code. Please refer to the last assignment sheet for instructions on using the Docker image, and on building and installing ParaView plugins.



An image of the correct solution, visualizing the magnitude is shown above. See the image for an overview of the necessary settings in the ParaView GUI in order to view your results.

Note that the drop-down menu and the coloring array named `Vector Property` is shown only when you have added it in the XML file.

Please hand in all three relevant source files.

You can extract the files from Docker by executing the following commands:

```
$ docker cp scivis_sheet_4:/root/scivis-2020/source/plugins/
        assignment_04/modules/exercise_05/exercise_05.h ./
$ docker cp scivis_sheet_4:/root/scivis-2020/source/plugins/
        assignment_04/modules/exercise_05/exercise_05.cxx ./
$ docker cp scivis_sheet_4:/root/scivis-2020/source/plugins/
        assignment_04/plugin/scivis_assignment_04.xml ./
```

Submission Deadline: 22.05.2020, 23:55

please hand in your submission through the ILIAS system.