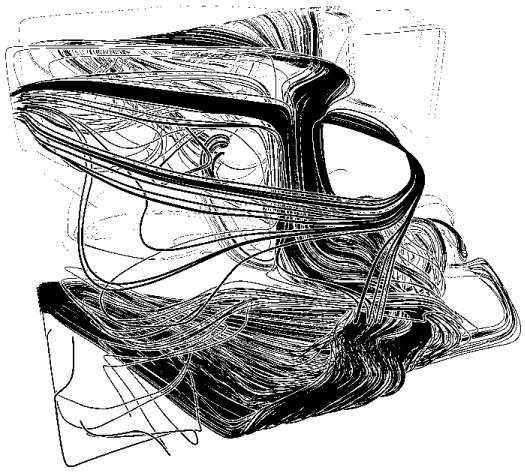
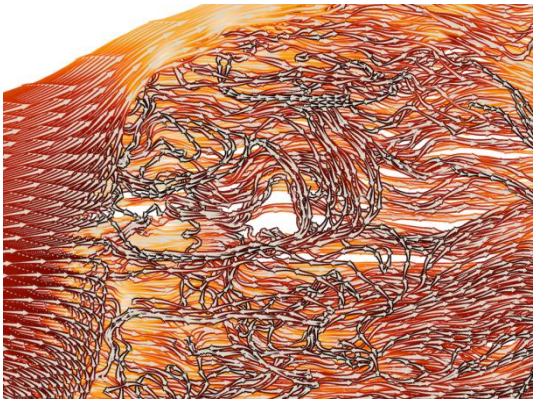
Project Proposal:

Illustrative Visualization in Fluid Dynamics



Illustrative rendering is a recent development in scientific visualization, incorporating inspirations from traditional illustration into scientific visualization applications. One important application domain within scientific visualization is showing the details of fluid dynamics simulations. For example, one can display the paths that particles are taking when moving through a fluid in a given space. The difficulty is that in order to understand the details of the motion it is often necessary to show many paths at the same time to support, for example, the visualization of vortices and other complex flow patterns. This can be supported using black-and-white illustrative visualization styles (see image) because individual lines do not take much space.



In the context of fluid dynamics visualization it is important to be able to show time-dependent behavior or even to visualize live data. This project will examine this problem: how to use the advantages of real-time illustrative rendering for the visualization of time-dependent flow data using GPU techniques. Based on an existing set of line rendering shaders, we will work with fluid dynamics data as it is provided by fluid dynamics scientists at LIMSI. The project will focus on realizing the rendering of time-dependent data. This could mean, for example, that shorter but time-dependent streamlines or pathlines are being used instead of the presently used long ones to illustrate the flow. One essential aspect is the display of additional data in the illustrative visualization style, based on an existing solution (see image). Such additional data can include, for example, speed, vorticity, heat, pressure, particle density, etc. For instance, visual variables such as color and patterns may be used for this purpose. An important aspect is also the evaluation of the resulting visualizations with the domains experts.

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