Special Guest Lectures

Using the Vish Infrastructure for Computing Streamlines Data Containing Several Hundred Curvilinear Blocks

Marcel Ritter, University of Innsbruck

Johnston Hall 338
December 16, 2008 - 10:00 am

Abstract:
Computing and visualizing streamlines are a standard approach to explore vector field data as they are e.g. generated in CFD. With the increasing use of simulation techniques and cheap computing power larger and more complex data sets are produced. Examples for higher data complexity are curvilinear grids (instead of e.g. uniform grids) and organization of grids in multiple blocks or adaptive meshes. The talk shortly describes the concepts of Vish, being a multi platform c++ visualization framework and application that provides: * a flexible network graph for connecting software modules, * a sophisticated caching approach and * a real-time renderer. The talk presents the underlying data model of Vish that already supports data loading and memory management of complex data structures such as multi block, AMR and curvilinear data. The main part of the talk will lead chronologically through the development process of the streamline module and will describe the main steps to get to the current state. A generalization process during development in combination with the data model that organizes grid and field structures led to the discovery of new capabilities that can be utilized in other visualization scenarios such as the convolution of grid points. The first working solution for complex data was a speed-programmed special case solution for a provided stir-tank fluid flow and had about 1200 of badly structured and hard to read lines of code. Also, the algorithms used were not time efficient. The generalization process for handling arbitrary curvilinear multiblock data efficiently blew the code up to over 2000 lines. Then, several pieces of code were extracted and moved to Vish's basic functionality decreasing the lines of code in the module to 600. Finally, more features were added again and the current lines are 750. Main features of the current solution: * Streamline seed point generation from arbitrary grid structures like an iso-surface of a pressure field (what comes naturally by using Vish's data model). * Grid convolution operation to generate complex seed grids. * Speeding up evaluations of other data fields on the streamlines by storing information for data interpolation. * Fast computation (e.g. compared to Tecplot) that handles simple uniform-grid data as well as multi-block curvi-linear data all hidden from the end user. * OpenGL rendered, color-mapped and animated streamlines, explorable in real-time At the end we discuss ideas for future development. There may be a demo showing the streamline features in a 2088 multi-block curvilinear dataset on the 4k projector in Frey Imaginarium subsequent to the talk. Feel free to ask questions, tell your needs for streamline visualization or add any suggestions you have.

Speaker's Bio:
Marcel Ritter studies Civil Engineering and Computer Science at the University of Innsbruck. He has completed his BSc in Computer Science in 2007 and is currently working on the his master project "Computing Geodesics in Numerical Spacetimes", which is conducted in cooperation with CCT. As introductory part he implemented computation of streamlines for use on CFD data stemming from the Cybertools project. He worked on several computer animation projects as an artist since 1999 and was rewarded, e.g., by a first prize for Professional/Compositing at the "Animago Award" 2004. He is co-founder of "Clockstone Software GmbH" in Innsbruck", where he has worked from 2004 to 2007 on the computer game "Avencast, Rise of the Mage" dominantly as a graphic artist. He studied Bassoon at the musical school in Innsbruck and graduated in March 2007. He played in several ensembles and orchestra such as the "European Philharmonic Orchestra", the "Mozarteum Orchester Innsbruck" and the wind orchestra "Stadtmusikkapelle Wilten."

Center for Computation & Technology
2003 Digital Media Center • Telephone: +1 225/578-5890 • Fax: +1 225/578-8957