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Ingredients of a Virtual Topology Lab: Extracting Topological Features of Flow Fields

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Johnston Hall 338
November 06, 2006 - 10:00 am

Abstract:
We introduce a virtual flow topology lab that combines several algorithms in order to analyze and visualize the topology of vector fields. While we explain the topological features of 2D steady and time-dependent as well as 3D steady vector fields, we present efficient algorithms to capture them. These include Feature Flow Fields and Saddle Connectors. Due to the strong correlation between the different topological features, a combination of several algorithms often leads to a new technique: as an example, a combination of Feature Flow Fields and Saddle Connectors can be used to find and track closed stream lines in 2D vector fields. Furthermore, we show that most techniques for extracting topological features can be built up from the following three core algorithms: * finding zeros in a 2D/3D field * integrating stream objects (streamlines, stream surfaces, etc.) * intersecting stream objects Those are the core ingredients for our virtual topology lab, which we implemented in our visualization suite Amira. We give an interactive demo where we analyze the topology of real-life data sets.

Speaker's Bio:
Tino Weinkauf studied computer science with the focus on computer graphics at the University of Rostock, Germany, where he received his M.S. degree in 2000. Since 2001 he has been performing research as a Ph.D. student at the Scientific Visualization department of Zuse Institute Berlin (ZIB). He is associated with the Collaborate Research Center (Sfb 557) "Control of Complex Turbulent Flows", where he works on feature based analysis and comparison techniques for flow fields. His current research interests focus on flow and tensor analysis, information visualization and visualization design.