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Title: Topology-Based Methods for Visualization

Abstract:

Several scientific data sets can be represented as a two- or three-dimensional scalar field. Isosurfaces, also called level sets, are extensively used for the visualization of these scalar fields. The Reeb graph is an abstract representation of the topology of all level sets of a scalar function. It is obtained by mapping each connected component of the level sets to a point. The Reeb graph serves as an effective user interface for selecting meaningful level sets and for designing transfer functions for volume rendering. It also finds several other applications including topology-based shape matching, topological cleaning of surface models, surface segmentation, and parametrization. In this talk, I will first motivate the application of Reeb graphs for data analysis and visualization. Next, I will briefly describe some algorithms for computing the Reeb graph of a piecewise-linear (PL) function. Finally, I will present a method for effective presentation of Reeb graphs that enables its application to interactive exploration of 3D scalar fields from various application domains.