

Contents

Part I Discrete Morse Theory

Computational Discrete Morse Theory for Divergence-Free 2D Vector Fields	3
Jan Reininghaus and Ingrid Hotz	
Efficient Computation of a Hierarchy of Discrete 3D Gradient Vector Fields	15
David Günther, Jan Reininghaus, Steffen Prohaska, Tino Weinkauff, and Hans-Christian Hege	
Computing Simply-Connected Cells in Three-Dimensional Morse-Smale Complexes	31
Attila Gyulassy and Valerio Pascucci	
Combinatorial Vector Field Topology in Three Dimensions	47
Wieland Reich, Dominic Schneider, Christian Heine, Alexander Wiebel, Guoning Chen, Gerik Scheuermann	

Part II Hierarchical Methods for Extracting and Visualizing Topological Structures

Topological Cacti: Visualizing Contour-Based Statistics	63
Gunther H. Weber, Peer-Timo Bremer, and Valerio Pascucci	
Enhanced Topology-Sensitive Clustering by Reeb Graph Shattering.....	77
W. Harvey, O. Rübel, V. Pascucci, P.-T. Bremer, and Y. Wang	
Efficient Computation of Persistent Homology for Cubical Data	91
Hubert Wagner, Chao Chen, and Erald Vuçini	

Part III Visualization of Dynamical Systems, Vector and Tensor Fields

Visualizing Invariant Manifolds in Area-Preserving Maps	109
Xavier Tricoche, Christoph Garth, Allen Sanderson, and Ken Joy	
Understanding Quasi-Periodic Fieldlines and Their Topology in Toroidal Magnetic Fields	125
Allen Sanderson, Guoning Chen, Xavier Tricoche, and Elaine Cohen	
Consistent Approximation of Local Flow Behavior for 2D Vector Fields Using Edge Maps	141
Shreeraj Jadhav, Harsh Bhatia, Peer-Timo Bremer, Joshua A. Levine, Luis Gustavo Nonato, and Valerio Pascucci	
Cusps of Characteristic Curves and Intersection-Aware Visualization of Path and Streak Lines	161
Tino Weinkauff, Holger Theisel, and Olga Sorkine	
Glyphs for Non-Linear Vector Field Singularities	177
Alexander Wiebel, Stefan Koch, and Gerik Scheuermann	
2D Asymmetric Tensor Field Topology	191
Zhongzang Lin, Harry Yeh, Robert S. Laramée, and Eugene Zhang	

Part IV Topological Visualization of Unsteady Flow

On the Elusive Concept of Lagrangian Coherent Structures	207
Jens Kasten, Ingrid Hotz, and Hans-Christian Hege	
Ridge Concepts for the Visualization of Lagrangian Coherent Structures	221
Benjamin Schindler, Ronald Peikert, Raphael Fuchs, and Holger Theisel	
Filtering of FTLE for Visualizing Spatial Separation in Unsteady 3D Flow	237
Armin Pobitzer, Ronald Peikert, Raphael Fuchs, Holger Theisel, and Helwig Hauser	
A Variance Based FTLE-Like Method for Unsteady Uncertain Vector Fields	255
Dominic Schneider, Jan Fuhrmann, Wieland Reich, and Gerik Scheuermann	

**On the Finite-Time Scope for Computing Lagrangian
Coherent Structures from Lyapunov Exponents** 269
Filip Sadlo, Markus Üffinger, Thomas Ertl, and Daniel Weiskopf

Scale-Space Approaches to FTLE Ridges 283
Raphael Fuchs, Benjamin Schindler, and Ronald Peikert

Index 297

Topological Methods in Data Analysis and Visualization

II

Theory, Algorithms, and Applications

Peikert, R.; Hauser, H.; Carr, H.; Fuchs, R. (Eds.)

2012, XI, 299 p. 200 illus., 106 illus. in color., Hardcover

ISBN: 978-3-642-23174-2