

Undervisningstøtte

av

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Semesteroppgave

til

PPU3210

Praktisk pedagogisk utdanning : Del I



Utdanningsvitenskapelig fakultet

Universitet i Oslo

November 2016

Abstract

Geodesics and hyperstreamlines are used to visualize second order tensors. We further look at a new way of visualizing second order tensor fields. By using the direction of geodesic curves in stead of eigenvectors, we make a different approach to so called integration methods. We extend the concept to include tensors which are not necessarily the metric.

Keywords: Tensor Field Visualization, Hyperstreamlines, Geodesics

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Part I

Teori

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Part II

Metode & Resultater

3 Tema 2

4 Utføring

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References

- [BH06] W. Bengler and H.-C. Hege. Strategies for Direct Visualization of Second-Rank Tensor Fields. In *Visualization and Processing of Tensor Fields*, pages 191–214. Springer-Verlag, 2006.
- [CL93] B. Cabral and L. C. Leedom. Imaging Vector Fields Using Line Integral Convolution. *Computer Graphics and Applications*, pages 263–270, 1993.
- [CPL⁺11] G. Chen, D. Palke, Z. Lin, H. Yeh, P. Vincent, R.S. Laramée, and E. Zhang. Asymmetric Tensor Field Visualization for Surfaces. *Visualization and Computer Graphics*, Vol. 17, Issue 12:1979–1988, December 2011.
- [Del94] T. Delmarcelle. *The Visualization of Second-Order Tensor Fields*. PhD thesis, Stanford University, 1994.
- [DH92] T. Delmarcelle and L. Hesselink. Visualizing Second Order Tensor Fields and Matrix. *Visualization '92 Proceedings*, pages 316–323, 1992.
- [DH93] T. Delmarcelle and L. Hesselink. Visualizing Second-Order Tensor Fields with Hyperstreamlines. *Computer Graphics and Applications*, 13(4):25–33, 1993.
- [FA15] F. Fu and N. M. Abukhdeir. A Topologically-Informed Hyperstreamline Seeding Method for Alignment Tensor Fields. *Visualization and Computer Graphics*, Vol. 21, Issue 3:413–419, March 2015.
- [Hei01] J. H. Heinbockel. *Introduction to Tensor Calculus and Continuum Mechanics*. Trafford Publishing, 2001.
- [HFHH04] I. Hotz, L. Feng, H. Hagen, and B. Hamann. Physically Based Methods for Tensor Fields Visualization. *IEEE Visualization*, pages 123–130, 2004.
- [HHK⁺14] M. Hlawitschka, I. Hotz, A. Kratz, G. E. Marai, R. Moreno, G. Scheuermann, M. Stommel, A. Wiebel, and E. Zhang. Top Challenges in the Visualization of Engineering Tensor Fields. In *Visualization and Processing of Tensors and Higher Order Descriptors for Multi-Valued Data*, pages 3–15. Springer-Verlag, 2014.
- [HHT07] H. Hauser, H. Hagen, and H. Theisel. *Topology-Based Methods in Visualization*. Springer-Verlag, 2007.
- [KASH13] A. Kratz, C. Auer, M. Stommel, and I. Hotz. Visualization and Analysis of Second-Order Tensors: Moving Beyond the Symmetric Positive-Definite Case. *Computer Graphics Forum*, 32(1):49–74, 2013.
- [KC08] P. L. Kundu and I. M. Cohen. *Fluid Mechanics*. Elsevier, 4 edition, 2008.

- [Kin04] G. L. Kindlmann. Superquadric Tensor Glyphs. *Joint Eurographics and IEEE Symposium on Visualization*, pages 147–154, 2004.
- [KMW⁺05] M. Kubicki, R. McCarley, C.-F. Westin, H.-J Park, R. Kikinis S. Maier, F. A. Jolesz, and M. E. Shenton. A Review of Diffusion Tensor Imaging Studies in Schizophrenia. *Journal of Psychiatric Research*, 41(1-2):15–30, 2005.
- [Lan14] H. P. Langtangen. Introduction to Classes. In *A Primer on Scientific Programming with Python*, pages 346–347. Springer-Verlag, 2014.
- [LHZIP07] R. S. Laramée, H. Hauser, L. Zhao, and F. H. Post. Topology-Based Flow Visualization, The State of the Art. In *Topology-Based Methods in Visualization*, pages 1–19. Springer-Verlag, 2007.
- [LR89] D. Lovelock and H. Rund. *Tensors, Differential Forms, and Variational Principles*. Dover, 1989.
- [Moo10] T. A. Moore. *A General Relativity Workbook*. β 0.92 edition, 2010.
- [MS71] P. Moon and D. E. Spencer. *Field Theory Handbook, 2.edition*. Springer Verlag, 1971.
- [PTHT09] V. Pascucci, X. Tricoche, H. Hagen, and J. Tierny. *Topological Methods in Data Analysis and Visualization*. Springer-Verlag, 2009.
- [SP04] W. Shen and A. Pang. Anisotropy Based Seeding for Hyperstreamline. *IASTED Conference on Computer Graphics and Imaging (CGIM)*, 2004.
- [Tri02] X. Tricoche. *Vector and Tensor Field Topology Simplification, Tracking, and Visualization*. PhD thesis, University of Kaiserslautern, 2002.
- [TS03] X. Tricoche and G. Scheuermann. Topology Simplification of Symmetric, Second-Order 2D Tensor Field. In *Geometric Modeling for Scientific Visualization*, pages 275–291. Springer-Verlag, 2003.
- [TSH01] X. Tricoche, G. Scheuermann, and H. Hagen. Tensor Topology Tracking: A Visualization Method for Time Dependent 2D Symmetric Tensor Fields. *Computer Graphics Forum*, 20(3):461–470, 2001.
- [TZP06] X. Tricoche, X. Zheng, and A. Pang. Visualizing the Topology of Symmetric, Second-Order, Time-Varying Two-Dimensional Tensor Fields. In *Visualization and Processing of Tensor Fields*, pages 225–240. Springer-Verlag, 2006.
- [WH06] J. Weickert and H. Hagen. *Visualization and Processing of Tensor Fields*. Springer-Verlag, 2006.
- [WM06] T. Wischgoll and J. Meyer. Locating Closed Hyperstreamlines in Second Order Tensor Fields. In *Visualization and Processing of Tensor Fields*, pages 257–267. Springer-Verlag, 2006.

- [WVB14] C.-F. Westin, A. Vilanova, and B. Burgeth. *Visualization and Processing of Tensors and Higher Order Descriptors for Multi-Valued Data*. Springer-Verlag, 2014.
- [ZTP06] X. Zheng, X. Tricoche, and A. Pang. Degenerate 3D Tensors. In *Visualization and Processing of Tensor Fields*, pages 241–256. Springer-Verlag, 2006.
- [ZZ15] E. Zhang and Y. Zhang. 3D Symmetric Tensor Fields : What We Know and Where To Go Next. In *Topological and Statistical Methods for Complex Data*, pages 111–124. Springer-Verlag, 2015.

