HOFFMANN Tim

研究概要

My current work focuses on the discretization of differential geometry and its applications as well as the technical aspects of mathematical visualization.

The main subject of discrete differential geometry is investigating discrete analogues of objects of classical differential geometry. Choosing ”good ” discretizations can preserve the integrable structure that lies behind many of the well known types of special curves, surfaces, parametrizations etc. This in turn leads to very stable and ”well behaving ” discretizations that preserve the integrability. These discrete analogs of integrable equations like the SineGordon and SinhGordon equations or the nonlinear Schr ¨ odinger equation the KdV equation and many more are in turn of interest in mathematical physics.

For many of the classical classes of special surfaces, discretizations have been found in the last years (for example isothermic surfaces, surfaces of constant curvature, minimal surfaces, affine minimal surfaces, Hashimoto surfaces, to name a few). Most of these surfaces come with a canonical parametrization which lead to special choices of (discrete) meshes in their discretizations.

It turns out the special classes of these meshes are of importance in various applications ?quadrilateral meshes with planar faces for example. A current focus in research is now to provide the mathematical background for design tools that can produce these mesh types while still allowing a maximum of free form modeling.

The discrete nature of the above mentioned objects makes them ideal for mathematical visualization and computer graphics as well and indeed mathematical visualization has always been a key ingredient in research in discrete differential geometry. While the visualization helps finding structures, the discretization of objects and notions of classical differential geometry is useful in computer graphics and visualization in itself: The applications here range from providing and investigating notions of curvature for polyhedral surfaces a discrete minimal surface over variational methods to smoothen noisy mesh data to discrete versions of physical behaviours.

I am co-developer and member of the steering committee of the software package jReality, a Java library for doing interactive mathematical and scientific visualizations and experiments, that scales from web applications to fully immersive CAVE-like 3D environments. It currently has stereo projection installations at Technische Universit ¨ at Berlin and City College New York. A third installation at Technical University Munich is in the planing stage.

「マス・フォア・インダストリ」にかかわる H20, 21 年度の研究実績概要

My research in the past couple of years was focused on classical subjects of discrete differential geometry as well as mathematical visualization. I was involved in the ongoing development of the visualization system jReality and I was and I currently am in the process of establishing a visualizaiton lab with 3d projection facilities at TU Munich. In the field of discrete differential geometry I worked together with W. Rossman, T. Sasaki, and M. Yoshida on the discretization of

flat fronts in hyperbolic space and on the Gauß map of s-isothermic cmc surfaces. In a more applied context I developed methods for local deformations of quad-meshes with planar faces (this gets implemented by a student at the moment). Quad-meshes with planar faces are of special interest in many applications (like architectural geometry) and up to now there have been no modeling tools that preserve the planarity intrinsically.

研究業績

1. P. Brinkmann, Ch. Gunn, T. Hoffmann, H. Pietsch, M. Schmies, and St. Weißmann. jReality — a thread-safe Java scene graph for mathematics, In MM '09: Proceedings of the seventeen ACM international conference on Multimedia, New York, NY, USA, 2009. ACM.
2. T. Hoffmann. Discrete Differential Geometry of Curves and Surfaces, Kyushu University MI Lecture notes Series Vol. 18, 2009
3. St. Weißmann, Ch. Gunn, P. Brinkmann, T. Hoffmann, and U. Pinkall. jReality: a java library for real-time interactive 3d graphics and audio., In MM '09: Proceedings of the seventeen ACM international conference on Multimedia, pages 927-928, New York, NY, USA, 2009. ACM.

プレプリント

4. T. Hoffmann, W. Rossmann, T. Sasaki and M. Yoshida, Discrete flat surfaces and linear weingarten surfaces in hyperbolic 3-space, submitted, 2009.

講演

1. 22.-25.8.08 invited speaker at the Geometry Symposium, Hirosaki, Japan
2.16.-17.9.08 invited speaker at the GCOE "Math for Industry" workshop, Tokyo, Japan
3.10.-14.12.08 invited speaker at the Integrable systems, Geometry and Visualization 2008 Conference Fukuoka, Japan.
4.13.12.08 Tutorial session at OSC 2008 Fukuoka University
5.15.-20.12.08 invited speaker at the Geometry, Integrability and Visualization Conference, Osaka, Japan und public lecture there.
6.11.-17.1.09 Discrete Differential Geometry conference Oberfolfach.
7.6.-9.7.09 invited speaker at the "Surfaces, Meshes, Geometric Structures" conference, Admond, Austria.

学位

PhD (Technische Universitat Berlin)