**Berlin
Mathematical
School**

BMS Friday Colloquium
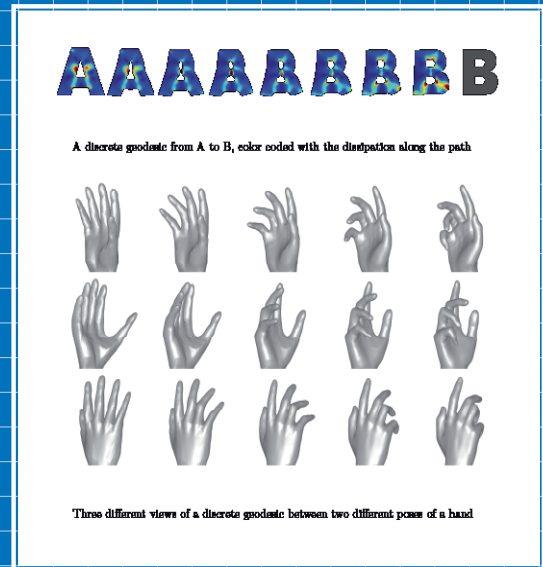
Friday, 8 January 2010, 2:00 pm

Tea before the lecture starts at 1 pm

BMS Loft, Urania
An der Urania 17, 10787 Berlin

Martin Rumpf (Bonn):

"Geodesics in the space of shapes"

A discrete geodesic from A to B, color coded with the dissipation along the path

Three different views of a discrete geodesic between two different poses of a hand

The talk will discuss ties between mechanics and the geometry on the space of shapes in imaging and vision. Thereby, we consider shapes which are implicitly described as boundary contours of objects. The main focus will be on a physically sound model of geodesic paths in the space of shapes.

Starting from a review of the literature in this field the general concept of shape space and the underlying challenges with respect to modeling, analysis and computation will be examined. Based on these considerations a new model will be developed.In fact, a geodesic path will be defined as the family of shapes such that the total amount of viscous dissipation caused by an optimal transport of material along the path is minimized. To render the corresponding problem numerically feasible, a variational time discretization will be introduced, which is based on a sequence of pairwise matching problems and is designed to be strictly invariant with respect to rigid body motions.

In the talk the limit for decreasing time step size will beinvestigated. It will be shown that the proposed model leads to the minimization of the actual geodesic length, where the Hessian of the pairwise matching energy reflects the chosen Riemannian metric on the shape space. Various Examples for 2D and 3D shapes will allow a detailed discussion of the notion of geodesics and the challenge to link this notion to physics.

Jürg Kramer, Humboldt-Universität zu Berlin
Christof Schütte, Freie Universität Berlin
Günter M. Ziegler, Technische Universität Berlin
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