Institut für Numerische Simulation
Rheinische Friedrich-Wilhelms-Universität Bonn

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Lecture course on

Geometry Processing & Discrete Shells

Summer term 2017, Selected Topics in Science and Technology (V5E2)

Behrend Heeren

Computer animation films have become increasingly popular within the last two decades. Artists in animation studios design sophisticated characters of rising complexity and authenticity. The character models are typically represented by triangle meshes consisting of tens or even hundreds of thousands of degrees of freedoms. Moreover, animators are able to generate movements of these artificial creatures that are almost indistinguishable from natural motions.
Geometry processing is an area of research that uses concepts from applied mathematics, computer science and engineering to design efficient algorithms as wells as flexible and effective tools supporting artists in creating such authentic animations. A comprehensive understanding of both the geometry and the physics of natural deformations and motion paths of complex shapes is essential for the creation of realistic models and efficient algorithms. In particular, lots of applications are linked to the mathematics of physical shape spaces.

In this course, we investigate the numerical treatment of thin shell problems along with discrete surface modeling (e.g. via discrete differential geometry) and consider numerical simulations of thin shell deformations and deformation paths. From a computational point of view, we study efficient implementations based on multiresolution schemes or differential representations. Finally, we consider fundamental operations in typical Computer Graphics applications (e.g. shape morphing, shape modeling, detail transfer etc.) in the context of shape space analysis. To this end, the space of triangle meshes is considered as a Riemannian manifold which is equipped with a comprehensive geodesic calculus.

Prerequisite: Basic knowledge in analysis, functional analysis and numerics. The course might also be suited for students in the Bachelor program.

When/where: Tuesday & Thursday, 12-14, Room N0.003

The lecture course will start on June, 13th!

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References: Botsch, Kobbelt, Pauly, Alliez, Levy, *Polygon Mesh Processing*, 2010.