TECHNISCHE UNIVERSITÄT DRESDEN

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Sommersemester 2024

Dresdner Mathematisches Seminar

Prof. Dr. Michael Hecht

CASUS – Center for Advanced Systems Understanding, Helmholtz-Zentrum Dresden-Rossendorf e.V. (HZDR)

Fast Multivariate Newton Interpolation for Downward Closed Polynomial Spaces and Applications to Numerical Differential Geometry

We introduce a fast Newton interpolation algorithm with a runtime complexity of O(Nn), where N denotes the dimension of the underlying downward closed polynomial space and n its lp-degree, where p > 1. We demonstrate that the algorithm achieves the optimal geometric approximation rate for analytic *Bos-Levenberg-Trefethen functions* in the hypercube. In this case, the Euclidean degree p = 2 emerges as the pivotal choice for mitigating the curse of dimensionality. The spectral differentiation matrices in the Newton basis are sparse, enabling the implementation of fast pseudo-spectral methods on flat spaces, polygonal domains, and regular manifolds.

In particular, we revisit our former contribution, entitled "Global Polynomial Level Sets (GPLS) for Numerical Differential Geometry of Smooth Closed Surfaces".

The GPLS provides an approximation for a wide range of smooth surfaces, which are initially given solely as point clouds, using a global polynomial level set. This enables efficient and accurate computation of various differential-geometric quantities, such as mean and Gauss curvature, or even higher-order terms like the Laplacian of mean curvature, in a straightforward manner. The GPLS significantly reduces the number of surface points required compared to classic alternatives that rely on surface meshes or embedding grids. We sketch extensions to higher dimensions, and discuss applications in numerical differential geometry.

Mittwoch, 15.05.2024, 17:00 Uhr – Willers-Bau, Raum C 129

Leitung: Prof. Dr. Oliver Sander

Vor dem Vortrag findet **ab 16:30 Uhr** ein gemeinsames **Kaffee-/Teetrinken** vor Hörsaal **WIL C 307 (!)** statt.

Bereich Mathematik und Naturwissenschaften

Fakultät Mathematik