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Lecture

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Geometric modeling for simulations

Special lecture & tutorial: winter term 2018/19 (details in KUSSS)

In this lecture we learn about the basic ideas behind geometric modeling for curves and surfaces. In computer aided geometric design shapes are often represented as polynomial or piecewise polynomial curves or surfaces.

We will study different approaches to represent 3D shapes that are commonly used in geometric modeling, such as B-spline patches, subdivision surfaces or spline manifolds.

These geometry representations can be used for many different tasks: Interpolate or approximate point data, interpolate given curves, approximate an implicitly given shape, create free-form shapes or perform numerical simulations.

In the tutorials we will study the implementational aspects of geometric modeling and perform some simple simulations.

What we learn: Bézier curves, triangular and tensor-product Bézier surfaces, B-splines and NURBS, tensor-product B-splines, spline fitting, subdivision, spline manifolds, web splines, isogeometric analysis, some implementations

What we need: Linear algebra, analysis, basic numerical analysis, basic programming skills (only for the tutorial)

Literature:

- Bézier and B-Spline Techniques. Prautzsch, Boehm & Paluszny (2002)
- Finite Element Methods with B-Splines. Höllig (2003)
- Spline Functions: Basic Theory. Schumaker (2007)
- Spline Functions on Triangulations. Lai & Schumaker (2007)
- Mathematics of Subdivision Surfaces. Andersson & Stewart (2010)