

NURBS-based Approaches in Fluid Flow Simulations

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As a basis of CAD systems, NURBS are closely connected to any engineering application, particularly since the idea of Isogeometric Analysis (IGA) has introduced NURBS to the numerical analysis. However, the generation of complex three-dimensional grids suited for IGA is still a challenge, limiting its use in the area of fluid mechanics. Nevertheless, methods for fluid simulation can profit immensely from the use of NURBS as a boundary description. Several approaches (here all connected to FEM) are possible:

1. Certain information needed for the computation (e.g. curvature or normals) is computed from a NURBS representing the boundary.
2. The computational domain is represented exactly using NURBS, but the solution is still interpolated using polynomials.
3. The NURBS represent the geometry and interpolate the solution at the boundaries.

The advantages of the discussed approaches are demonstrated on various numerical examples of fluid flow.