11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20–25, 2014, Barcelona, Spain

ADAPTIVE LOCAL REFINEMENT IN ISOGEOMETRIC CONTACT ANALYSES USING HIERARCHICAL B-SPLINES

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Key words: *Adaptive refinement, Contact mechanics, Hierarchical B-splines, Isogeometric analysis.*

Within the isogeometric framework, non-uniform rational B-splines (NURBS) approximations have recently demonstrated many advantages in the computational treatment of frictionless and frictional multi-patch contact problems in 2D [1–3] and 3D [4, 5], mainly due to their higher and tailorable smoothness in comparison with standard C^0-continuous Lagrange discretizations.

A key problem of multivariate NURBS basis functions, however, is their rigid tensor product structure, which implies that refinement is a global process propagating throughout the domain. A possible way to improve the quality of contact results in terms of local pressures and global time-history curves with limited increase in the computational effort is represented by local refinement. Recently, analysis-suitable T-splines have been applied for this purpose [6]. Another effective alternative are hierarchical B-splines, as introduced in [7]. The hierarchical organization of B-splines and NURBS domains can be implemented with manageable coding efforts into tree-like data structures and allow for local refinement within the isogeometric framework.

The present work reports on the formulation and implementation of local adaptive refinement for frictionless contact problems using hierarchical B-splines interpolations. The principle of B-spline subdivision is here combined with the concept of adaptivity for an efficient hierarchical refinement of contact bodies and surfaces.

A Gauss-point-to-segment formulation is adopted for the enforcement of the contact constraints, whereby a desired number of quadrature points is located on the contact surface and the contact constraints are enforced independently at each quadrature point. This simple formulation is applied to the solution of 2D large deformation contact problems.

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