Nitsche's method for isogeometric thermo-mechanical contact problems

Alexander Seitz, Wolfgang A. Wall, Alexander Popp
Technical University of Munich
Bundeswehr University Munich

This talk presents the application of Nitsche's method to finite deformation thermo-mechanical contact problems in the framework of isogeometric analysis. The isogeometric concept thereby proves to be beneficial in two ways: for once, contact mechanics relies on an accurate and, at best, smooth surface representation, which can be achieved using NURBS basis functions. The second advantage is related to Nitsche's method itself, which requires a consistent contact traction vector derived from the stress state of the underlying bulk discretization. In case of classical finite elements, this stress is discontinuous across element boundaries, thus resulting in a discontinuous approximation of the contact traction. Due to the higher inter-element continuity of NURBS basis functions, the contact traction becomes continuous in isogeometric analysis. In the present contribution, Nitsche's method will be applied to various constraints at the contact interface, namely the non-penetration condition in normal direction, Coulomb's law of friction in tangential direction of the mechanical problem as well as heat conductivity and frictional heating introduced in the thermal field. Numerical examples demonstrate the optimal convergence rates achieved from the variationally consistent treatment of all interface conditions.