Recent Advances in Third Medium Contact

P. Wriggers, Bing-Bing Xu, J. Korelc

Leibniz University Hannover, Germany

The third medium contact approach has been successfully employed in structural applications and extended to various optimization problems. This discretization technique replaces classical contact formulations and algorithms by introducing a compliant interfacial layer - referred to as the third medium - between the contacting bodies. Unlike traditional contact methods, this formulation naturally accommodates finite deformations at the interface. As the two bodies approach each other, the third medium undergoes compression and effectively acts as a deformable barrier, preventing interpenetration and transmitting contact forces in a smooth and numerically stable manner.

The approach is also applied to coupled problems, with focus on thermo-mechanical analysis. Then heat conduction must be incorporated into the model, which typically requires specialized interface laws when using classical contact formulations. These laws aim to capture the complex thermal behavior at the contact interface, including discontinuities and varying conductance. In contrast, the third medium approach offers the advantage to account for the interface behavior without the need for additional interface conditions. This includes the gradual heat transfer through the surrounding gas when the bodies are near each other, as well as the localized heat conduction that occurs upon physical contact. As a result, the third medium naturally captures both non-contact and contact-phase thermal conduction within a unified framework.

In this talk, we discuss the different approaches that can be applied within third media contact discretization schemes for linear and quadratic ansatz functions. The discretization is carried out using finite and virtual elements and then applied to mechanical and thermo-mechanical contact problems in two- and three-dimensions. The presentation includes comparison of different discretization schemes and algorithms in the light of robustness, efficiency and accuracy