TWO DIMENSIONAL MORTAR CONTACT METHODS FOR LARGE DEFORMATION FRICTIONAL SLIDING

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This paper presents a new mortar-based formulation for the solution of two dimensional frictional contact problems involving finite deformation and large sliding. As is widely recognized, traditional node-to-surface contact formulations have several drawbacks in solution of deformable-to-deformable contact problems, including lack of general patch test passage, degradation of spatial convergence rates, and robustness issues associated with the faceted representation of contacting surfaces. The mortar finite element method, initially proposed as a technique to join dissimilarly meshed domains, has been shown to preserve optimal convergence rates in tied contact problems (see [2] for a recent review), and is examined here as an alternative spatial discretization method for large sliding contact.

In recent years, the mortar element method has already been successfully implemented to solve frictional contact problems with linearized kinematics (see [1]). However, in the presence of large deformations and finite sliding, one must face difficulties associated with the definition and linearization of contact virtual work in the case where the mortar projection has a direct dependence on the tangential relative motion along the interface. In this paper, such a formulation is presented, with particular emphasis on key aspects of the linearization procedure and on the robust description of the friction kinematics. Some novel techniques are proposed to treat the nonsmoothness in the contact geometry and the searching required to define mortar segments. A number of numerical examples illustrate the performance and accuracy of the proposed formulation.

References

[1] T. W. McDevitt, and T. A. Laursen, “A Mortar-finite Element Formulation for Frictional Contact Problems ,” *International Journal for Numerical Methods in Engineering*, v. 48, p. 1525-1547, 2000.

[2] B.I. Wohlmuth, “Discretization Methods and Iterative Solvers Based on Domain Decomposition ,” *New York: Springer*, 2001.