Across-partition Contact Analysis with Adaptive Tracking

Qili Fang* **and Bassam A. Izzuddin†**

Computational Structural Mechanics (CSM) group,
Department of Civil and Environmental Engineering,
Imperial College London, SW7 2AZ, U.K.
Web page: https://www.imperial.ac.uk/CSM
* e-mail: qili.fang14@imperial.ac.uk
† e-mail: b.izzuddin@imperial.ac.uk

ABSTRACT

Contact finite element problems, with their continuously growing size and complexity, have necessitated the utilisation of parallel computation. Modelling contact behaviour across different partitions allows greater flexibility in problem decomposition and hence yields better load balancing in parallel analysis. In a finite element realisation, the non-overlapping domain decomposition method is one of the most suitable problem decomposition method for parallel computation. In the context of contact analyses with parallel computation , dual-interface-based domain decomposition methods [1] are adopted in the current work for their considerable flexibility without degradation of accuracy and convergence behaviour compared with penalty-based domain decomposition method [2] and those based on Dirichlet-Neumann coupling [3]. However, nonlinearity in contact problems still poses great difficulties for dual-interface-based domain decomposition methods. In addition, the *a priori* unpredictability of the contact regions and contact states complicate the across-partition contact enforcement.

The current work proposes a novel adaptive node-to-surface contact approach to discretise the across-partition contact boundaries and to trace the evolution of contact locations [4, 5]. The assumption of small incremental displacements is adopted, which a) effectively avoids excessive coupling between the displacement DOFs on the master and slave contact boundaries, b) reduces significantly the communication overhead between the parallel processors, and c) facilitates a flexible across-partition adaptive analysis. Several examples are presented which demonstrate the ability of the proposed strategy is found to provide a good balance between accuracy and computational efficiency for contact problems utilising parallel domain decomposition.

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