THE SHIFTED BOUNDARY METHOD FOR COMPUTATIONAL MECHANICS

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Embedded/immersed/unfitted boundary methods obviate the need for continual re-meshing in many applications involving rapid prototyping and design. Unfortunately, many finite element embedded boundary methods are also difficult to implement due to the need to perform complex cell cutting operations at boundaries, and the consequences that these operations may have on the overall conditioning of the ensuing algebraic problems. We present a new, stable, and simple embedded boundary method, named "shifted boundary method" (SBM) [1,2,3], which eliminates the need to perform cell cutting. Boundary conditions are imposed on a surrogate discrete boundary, lying on the interior of the true boundary interface. We then construct appropriate field extension operators by way of Taylor expansions, with the purpose of preserving accuracy when imposing the boundary conditions. We demonstrate the SBM on large-scale solid and fracture mechanics problems.

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