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Analysis of an MLPG solution for 3D potential problems

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ABSTRACT

Meshless methods have been explored in many 2D problems and they have been shown to be as accurate as Finite Element Methods (FEM). Compared to the vast literature on 2D applications, papers on solving 3D problems by meshless methods are surprisingly few. Indeed, a main drawback of these methods is the requirement for accurate cubature rules. This paper focuses on the so called Meshless Local Petrov Galerkin (MLPG) methods. We show that accurate solutions of 3D potential problems can be attained, provided suitable cubature rules are identified, sparse data structures are efficiently stored, and strategies for speeding up the computation flow by avoiding unnecessary integral evaluations are devised. The ensuing MLPG linear systems result to be well conditioned, positive definite ones. Their conditioning does not increase much when the mesh size decreases. We show that cubature errors can lower MLPG convergence speed.

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