VI International Conference on Adaptive Modeling and Simulation
ADMOS 2013
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ADAPTIVE MESHLESS ANALYSIS OF THIN SHELLS WITH THE AID OF THE INTERIOR PENALTY METHOD

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Abstract. Meshless approximations provide a great resource in the analysis of structures as the desired continuity in the approximated fields can be achieved. This feature is well suited for thin structures like shells, as stresses can be obtained as smoothly as desired. However, the non-interpolatory characteristic of such approximants makes the imposition of essential boundary and interface conditions not straightforward. For instance, in the classical Element-Free Galerkin Method (EFG), Lagrange multipliers are used to enforce such conditions. Recently, an alternative has been revisited: the Interior Penalty Method, usually referred to as Nietsche's Method, which identifies the Lagrange multiplier with the flux at the essential or interface boundary and introduces a penalty parameter, which warrants the convergence rate of the approximation. In the elasticity case, the reaction tractions are the same as the stress normal to the boundary. The present work aims at developing the study of this method in the linear elastic analysis of shells, firstly for the imposition of boundary displacements and latter for multi-region problems. In the former case, its advantage over Lagrange Multipliers is that no additional degrees of freedom are introduced and there is no need to introduce a new approximation space (which would have to obey an inf-sup condition), in the latter, refinement over one portion of the domain can be performed without affecting other regions, even maintaining their stiffness matrices, and different regions can be discretized with different approximants, *e.g.*, finite elements.