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A Comparison of Efficient Meshless Methods with Accelerated Differentiation Algorithms

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Summary

A series of efficient meshless methods with their own differentiation algorithm are compared in this paper. The computational cost for complicated derivative of the interpolation functions in the meshless analysis is more expensive than traditional element-based method. Several promising meshless methods with simplified and accelerated algorithm are recently proposed in order to reduce or avoid the direct differentiation of meshless interpolation function. In the framework of Meshless Local Petrov-Galerkin (MLPG) method, a mixed approach allows to use the independent interpolation scheme for the displacements and its gradients and stresses. It also reduces the support size and lowers requirements for trial function. In MLPG mixed Finite Difference Method, the divergence of the stress tensor is more efficiently obtained through the generalized finite difference method. Differential quadrature (DQ) method can be adopted for computing derivatives of a meshless interpolation from a weighted linear sum of the function value at neighboring nodes. For aforementioned methods, the accuracy, the efficiency, and applicability of the methods are numerically tested to linear static elasticity problems. Their advantages and disadvantages are compared and discussed based on numerical observation.

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