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AN IMMERSED SMOOTHED PARTICLE GALERKIN METHOD FOR COMPOSITE SOLID ANALYSIS

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In this study, we introduce a new particle method for the linear and nonlinear analyses in composite solid mechanics applications. The formulation is first established for a solving of partial differential equation of linear elastic problem. The introduced smoothed particle Galerkin formulation can be shown closely related to the least-square stabilization method [1] for the elimination of zero-energy modes in conventional particle methods. The formulation is next extended to the linear and nonlinear analyses of composite materials using an immersed meshfree approach [2]. The immersed meshfree method utilizes the overlapping sub-domains to approximate the composite solid. Since each sub-domain is discretized independently, the generation of conforming mesh as that needed in the finite element analysis of composite materials [3] can be evaded. A meshfree convex approximation [4] is employed to approximate the overlapping sub-domains and to enforce the global Dirichlet boundary conditions. In addition, a point-wise continuity is imposed on the displacements of interfacial nodes across the interface. This leads to a nonconforming meshfree Galerkin formulation which is integrated nodally and can be shown to satisfy an optimal error estimate in the energy and L^2 norms. Several numerical benchmarks are analyzed to study the accuracy and the applicability of the method.

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