A posteriori error estimation technique for particle methods using meshfree compact schemes

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ABSTRACT

Particle methods and meshfree methods are one of the numerical methods for solving partial differential equations. Since mesh (or grid/cell) to part a whole domain into small sub-divisions is not required for particle methods and truly meshfree methods, they are frequently applied for numerical analyses of continua with large deformation, fragmentation/coalescence, and topology change of domain. Besides, adaptive procedures based on a posteriori error estimation are important interest of numerical methods to reduce numerical error and enhance computational efficiency.

Adaptivity using various a posteriori error estimation techniques is popular in the finite element methods and the finite volume methods, and in meshfree/particle methods, it is mainly utilized in Galerkin-based weak form methods such as element free Galerkin methods; however, it is less common in strong form meshfree/particle methods.

In this study, a posteriori error estimation technique using meshfree compact schemes[1] is presented for strong form meshfree/particle methods. Meshfree compact schemes are utilized as a higher order solution reconstruction algorithm, and to replace true solution with reconstituted solution in the pointwise local error calculations provides a posteriori error estimation technique. Furthermore, in order to reduce numerical error and improve computational efficiency, information of approximated pointwise local errors are utilized for adaptive relocation of particles.

REFERENCES