

SFEM-based Variable-node finite elements and their applications

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Abstract

The meshfree approach leads to the extension of the trial function space of finite elements, linking to the new finite element formulation called “Smoothed Finite Element Method”, which is based upon the gradient smoothing. This enables one to overcome some shortcomings of the conventional finite element method in that it provides a flexible adjustment in deploying nodal points, yielding SFEM(Smoothed Finite Element Method)-based variable-node finite elements. The SFEM variable node finite elements turn out to be extremely useful in dealing with a class of complex problems entailing evolving interface and discontinuity as well as multiscale problems. In this presentation, we discuss various aspects of this approach in conjunction with its applications to some of the representative challenging problems: first, quasicontinuum application for simulation of graphene indentation; second, contact mechanics; lastly, fluid-solid interaction problems. Furthermore, future perspectives of this methodology is discussed.

Keywords: Smoothed FEM, Variable-node elements, quasicontitnum, contact mechanics, fluid-solid interactions