A Meshfree Galerkin Method based on Barycentric Coordinates

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Abstract

Meshfree methods open up new possibilities in the simulation of technical demanding processes. Especially Galerkin type meshfree methods have the advantage of being free from tensile instabilities. However the lack of the Kronecker delta property, the location of integration points and the determination of the radius of the kernel are still big challenges of these kinds of solution schemes. The OTM method, which was recently developed, tries to overcome these issues, but the imposition of essential boundary conditions is still unsatisfactory. Barycentric coordinates, which are mainly used in computer aided design, have the advantage in possessing the Kronecker delta property. Furthermore, mean value coordinates, which belong to this type of interpolation functions, can also be used if the domain of application is not convex. Both characteristics make mean value coordinates very attractive to meshfree methods. They perfectly combine the determination of the nodes in the kernel and the computation of the shape functions of the support domain. Due to these benefits a new meshfree scheme based on barycentric coordinates is developed and will be presented in detail. The range and the scope of the method are illustrated by means of some examples of application. Especially the Taylor anvil benchmark is thereby a good test to compare the developed approach with standard methods in computational engineering.