Sukumar, N.; **Tabarraei, A.**

Conforming polygonal finite elements. (English) Zbl 1073.65563

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Summary: Conforming finite elements on polygon meshes are developed. Polygonal finite elements provide greater flexibility in mesh generation and are better-suited for applications in solid mechanics which involve a significant change in the topology of the material domain. In this study, recent advances in meshfree approximations, computational geometry, and computer graphics are used to construct different trial and test approximations on polygonal elements. A particular and notable contribution is the use of meshfree (natural-neighbour, nn) basis functions on a canonical element combined with an affine map to construct conforming approximations on convex polygons. This numerical formulation enables the construction of conforming approximation on n-gons ($n \geqslant 3$), and hence extends the potential applications of finite elements to convex polygons of arbitrary order. Numerical experiments on second-order elliptic boundary-value problems are presented to demonstrate the accuracy and convergence of the proposed method.

MSC:

65N30	Finite element, Rayleigh-Ritz and Galerkin methods for boundary value problems involving PDEs
65N12	Stability and convergence of numerical methods for boundary value problems involving PDEs
65N50	Mesh generation, refinement, and adaptive methods for boundary value problems involving PDEs
35J25	Boundary value problems for second-order elliptic equations

Keywords:

meshfree methods; natural neighbour interpolants; natural element method; Laplace interpolant; Wachspress basis functions; mean value co-ordinates; conforming finite elements; mesh generation; numerical experiments; second-order elliptic boundary-value problems; convergence

Full Text: DOI

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