Isogeometric collocation method for elasticity problems containing singularities

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Abstract

Isogeometric analysis(IGA), introduced by Hughes, et al, is a method which combines both engineering design obtained by CAD and Finite Element(FE)-analysis of the design. Many researchers have published their work in IGA using Galerkin method but not many are working on IGA-Collocation. In this dissertation, IGA-Collocation method has been applied to find numerical solutions of elliptic boundary value problems containing regular as well as singular solutions. For collocation at least C^1 basis function is required therefore B-spline basis functions have been modified to make it continuous at nodes. To deal with singularity, B-spline basis functions in the neighborhood of singularity has been enriched by using an enrichment function. Enriched IGA-Collocation method is tested to problems with regular as well as singular solutions. Also, we claim that our method is more effective and economical than other existing methods in handling problems with singularities because IGA-Collocation method requires less computation than IGA-Galerkin method. Also, Schwarz's alternating method in the framework of IGA-Collocation is discussed in this dissertation. In this method, domain is decomposed into two subdomains and solve the problem independently in these subdomains. We start with some initial guess and iterate until we get a solution of desired accuracy. This technique has been applied to one- and two-dimensional problems by splitting domain into overlapping as well as non-overlapping subdomains. Elasticity problems containing singularities are also solved by alternating method. Numerical results are presented and compared with the results obtained by IGA-Galerkin method.

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