The Strong Formulation Finite Element Method: Stability and Accuracy

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The Strong Formulation Finite Element Method (SFEM) is a numerical solution technique for solving arbitrarily shaped structural systems. This method uses a hybrid scheme given by the Differential Quadrature Method (DQM) and the Finite Element Method (FEM). The former is used for solving the differential equations inside each element and the latter employs the mapping technique to study domains of general shape. A general brief review on the current methodology has been reported in the book [1] and recalled in the works [2,3], where a stress and strain recovery procedure was implemented. The aim of this manuscript is to present a general view of the static and dynamic behaviors of one- and two-dimensional structural components solved by using SFEM. It must be pointed out that SFEM is a generalization of the so-called Generalized Differential Quadrature Finite Element Method (GDQFEM) presented by the authors in some previous papers [4-8]. Particular interest is given to the accuracy, stability and reliability of the SFEM when it is applied to simple problems. Since numerical solutions - of any kind - are always an approximation of physical systems, all the numerical applications are compared to well-known analytical and semi-analytical solutions of one- and two-dimensional systems. Ultimately, this work presents typical aspects of an innovative domain decomposition approach that should be of wide interest to the computational mechanics community.

References

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