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Soft Core Plane State Structures Under Static Loads Using GDQFEM and Cell Method

E. Viola[1], F. Tornabene[1], E. Ferretti[1] and N. Fantuzzi[1]

Abstract. The aim of this work is to study the static behavior of 2D soft core plane state structures, which are very common in many engineering fields. Deflections and inter-laminar stresses caused by forces can have serious consequences for strength and safety of these structures. Therefore, an accurate identification of the variables in hand is of considerable importance for their technical design. In particular, it will be shown how a soft core structure can be tailored as a function of the stress profile of the two constituent materials. It is obvious that, since a complex plane structure is under consideration, there is no analytical solution which can be used to solve the physical system problem. Only numerical procedures can be considered to solve a two-material system subjected to generic static loads.

In this study two advanced numerical technique will be used: the Generalized Differential Quadrature Finite Element Method (GDQFEM) procedure and the Cell Method (CM). The first is a numerical technique based on the classic Generalized Differential Quadrature (GDQ) rule [1,2,3] and it operates differently from the well-known Finite Element Method (FEM). In fact, compatibility conditions are enforced between the element boundaries, such as in the CM contact problems [4,5]. In order to capture the discontinuity between two boundaries, the compatibility conditions have to be applied at each disconnection, when the GDQFEM is used. New results are presented to illustrate comparisons between GDQFEM, CM and FEM.

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[1] DICAM Department, University of Bologna, Italy