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GDQFEM and Cell Method Numerical Simulations of Continuous Media with Cracks and Discontinuities

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Abstract. In the present paper the Generalized Differential Quadrature Finite Element Method (GDQFEM) is applied to solve plane state structures with generic discontinuities, such as linear cracks and holes of various shapes. The GDQFEM is an extension of the Generalized Differential Quadrature developed by Shu [1]. The static analysis of the structures at issue is investigated. In particular, the results in terms of stresses and displacements for classical and advanced plane stress problems with discontinuities are compared to the Cell Method (CM) [2, 3, 4] and the Finite Element Method (FEM).

The GDQFEM numerical technique is based on the idea of conventional integral quadrature. In particular, the multi-domain technique is implemented in a MATLAB code for solving irregular domains with holes and cracks. In literature, among all, two-dimensional GDQ problems have been solved considering static [5] and dynamic behavior [6] of different structures. In order to demonstrate the accuracy of the proposed methodology, several numerical examples are shown. Some graphical representations of stress and displacement distributions obtained via GDQFEM are shown in order to compare them with the corresponding solutions calculated by CM and FEM.

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