

Report on a novel concave-admissible quadrilateral 8 node plane element

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Abstract

Severe accuracy loss will happen on the occasion of element distortion, and the program may even fail to finish the calculation when there are elements which are concave. In this study, a novel concave-admissible 8 node quadrilateral plane element is developed within the framework of assumed displacement quasi-conforming method. The B-net method is used for calculation of area integral items and gives results with high precision within convex and even concave quadrangles. Numerical analysis on the element shows its trial functions represent exactly all polynomial terms of order less or equal to 2 in the Cartesian coordinates, which is also proved in numerical experiment described in Fig.1. Numerical results and comparisons with existing elements show that present element exhibits a remarkable robustness and insensitivity with extreme mesh distortions, as well as good accuracy. For the Cook beam problem, satisfactory results can be obtained when the mesh become severely distorted, as shown in Fig. 2. The work described in this abstract is expressed in detail in a full-length paper by Qingyuan Hu, Yang Xia, Ping Hu and Chongjun Li with title “A concave-admissible quadrilateral quasi-conforming plane element using B-net method”, which is under review by European Journal of Mechanics - A/Solids.

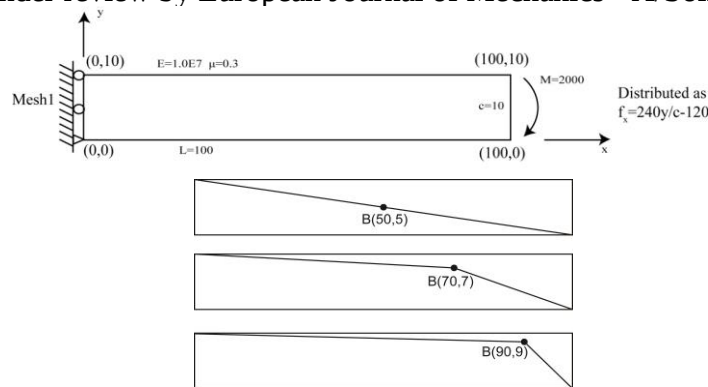


Fig. 1. Pure bending problem for a cantilever beam and distorted mesh with 2 elements. The position of point *B* is changing, but present result of deflection is always same as analytical one.

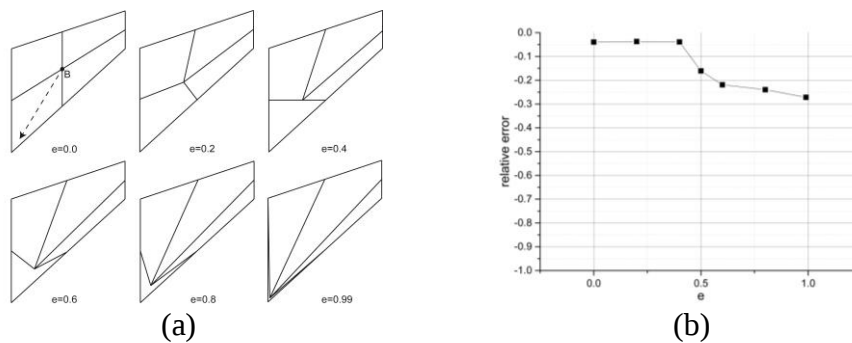


Fig. 2. Cook's skew beam problem. (a) distorted meshes; (b) the relative error of the vertical deflection result at right down point using present element.

Keywords: Quasi-conforming, B-net method, plane element, mesh distortions, concave admissible