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Arbitrary crack growth in continuum-based shell and bi-material with X-FEM

***Z. Zhuang, QL. Zeng, BB. Cheng, ZL. Liu, DD. Xu**

School of Aerospace, Tsinghua University, Beijing 100084, China

*Corresponding author: zhuangz@tsinghua.edu.cn

Crack propagating along a curved or rough path in planes or curved surfaces is a common phenomenon in many kinds of engineering fields. A new X-FEM algorithm on the continuum-based (CB) shell element is established. A program is developed, which is applied to several problems of planar discontinuities and arbitrary crack propagation in shells. The variation of the shell thickness can be considered. As the enriched shape functions are constructed in the body element, the situation of crack not perpendicular to the mid-surface of the shell can be conveniently considered. The formula for calculating three-dimensional (3D) stress intensity factors and 3D maximum energy release rate criterion is used in the program. Besides, sub-interfacial crack growth in bi-materials is also studied. The computed crack path and phase angle are the same with the data obtained in the experiment. Further research reveals the effect on the equilibrium state of mode-I crack propagation made by the material inhomogeneity, loading asymmetry and the initial crack length. The experience formula has been developed to guide the experimental researches.

Keywords: crack growth, continuum-based shell, bi-material, X-FEM