3D fracture software system based on ordinary finite element method with minimal meshing effort

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ABSTRACT

In this research, we have been developing a fracture/crack propagation analysis system for damaged structures. The system can fully automate the crack propagation analysis. The analysis system is based on the Finite Element Method (FEM) to perform the solid mechanics analysis and the Delaunay tessellation technique to generate the finite element mesh. The crack parameters such as the stress intensity factors and the J-integral are evaluated by the virtual crack closure-integral method (VCCM) or by the domain integral method. The second order tetrahedral element is adopted to perform the finite element computations so that we can automate the mesh generation processes by using the Delaunay tessellation technique. The methodologies to perform the evaluation of the crack parameters have been developed by the authors [1, 2, 3] are adopted in the analysis system.

The crack mesh generation software that has been developed by the authors (see, for example, [4]) does not require any interactive operations for the analysts. Furthermore, when the interaction integral method is adopted, mapped mesh is not required at the vicinity of the crack front. In this regard, we state “minimal meshing effort” in the title of this abstract.

The software system requires only a few manual operations to perform the crack/crack propagation analysis although it can utilize ordinary finite element software. A few demonstrations will be shown at PANACM2015.

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