

Variable-Order Singular Boundary Element for Calculation of Three-Dimensional Stress Intensity Factors

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A new variable-order singular boundary element has been developed for stress analysis of three-dimensional cracks and multi-material junctions. The singular element shape functions include the variable orders of singularity and the angular profiles of the field variables. The stress intensity factors are formulated as nodal unknowns and are obtained directly from the final system of equations without the need of post processing, such as three-dimensional J-integral. Two numerical examples are presented to demonstrate the accuracy and versatility of the singular element: a penny-shaped crack in homogeneous medium and a corner in a bi-material system. The stress intensity factors which are normally difficult to determine using conventional numerical techniques are hereby easily computed with good accuracy using relatively coarse elements.

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