Hypersingular BEM for Piezoelectric Solids: Formulation and Applications for Fracture Mechanics

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Summary

A general mixed boundary element formulation for three-dimensional piezo-electric fracture mechanics problems is presented in this paper. The numerical procedure is based on the extended displacement and traction integral equations for external and crack boundaries, respectively. Integrals with strongly singular and hypersingular kernels appearing in the formulation are analytically transformed into weakly singular and regular integrals. Quadratic boundary elements and quarter-point boundary elements are implemented in a direct way in a computer code. Electric and stress intensity factors are directly computed from nodal values at quarter-point elements. Crack problems in 3D piezoelectric bounded and unbounded solids are solved. The obtained results are shown to be accurate by comparison with other results existing in the literature. The approach presented for the first time in this paper should be useful for future research and development since it can be used in a simple way for general 3D piezoelectric fracture mechanics problems.