An Integral Formulation for 2D Elasticity

Hong-Hui Yu
Mechanical Engineering Department
The City College of the City University of New York
Convent Ave at 140th street, New York, NY 10031

Abstract

A new boundary integral formulation for two dimensional elasticity problem is derived for both anisotropic and isotropic materials. Instead of a set of boundary integral equations relating the displacements and tractions along the boundary of a solid body, which were used in the conventional boundary element method, the new formulation gives a relation between the tractions and the tangential derivatives of the displacements along the boundary. The stresses and displacements in the solid body are expressed in terms of boundary integrals. Some analytical solutions are derived by using the new formula. The formulation is further extended to allow dislocations in a finite body, so that the singular stress field can be directly solved without involving the linear superposition technique which was often used in the literatures. The general framework of setting up a boundary value problem and the general scheme for boundary element implementation are discussed. In the new formulation, all the integral kernels are Cauchy type; the integrations at each element can be analytically obtained, and the singularity can be removed. The boundary layer effect, which is a common problem in the conventional boundary element method, is eliminated. These features make the new method an appealing tool in studying structural evolution due to dislocation motion or mass diffusion in small structures.