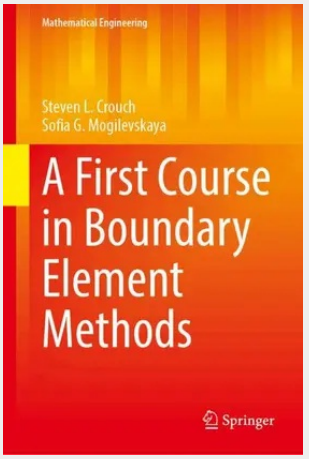
Crouch / Mogilevskaya

A First Course in Boundary Element Methods



This textbook delves into the theory and practical application of boundary integral equation techniques, focusing on their numerical solution for boundary value problems within potential theory and linear elasticity. Drawing parallels between single and double layer potentials in potential theory and their counterparts in elasticity, the book introduces various numerical procedures, namely boundary element methods, where unknown quantities reside on the boundaries of the region of interest. Through the approximation of boundary value problems into systems of algebraic equations, solvable by standard numerical methods, the text elucidates both indirect and direct approaches. Indirect methods involve single or double layer potentials separately while direct methods combine these potentials using Green's or Somigliana's formulas. The two approaches give comparable results for general boundary value problems. Tailored for beginning graduate students, this self-contained textbook offers detailed analytical and numerical derivations for isotropic and anisotropic materials, prioritizing simplicity in presentation while progressively advancing towards more intricate mathematical concepts, particularly focusing on two-dimensional problems within potential theory and linear elasticity.

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