ME 6900 BOUNDARY ELEMENT METHODS IN ENGINEERING

2004 Catalog Data: ME 6900. Intro. to Boundary Element Methods in Engineering  Lec. 3. Cr. 3.
Laplace’s equation; Navier’s equations; fundamental solutions; Cauchy Principal Values; Hadamard Finite Parts; regularization; direct and indirect methods; domain terms; Symmetric-Galerkin methods; fast summation methods.
Prerequisites: MATH 5510, CEE 6330, and any one of the following: ME 5180, CEE 7610 or MATH 6520.

Resources:
Engineering Analysis with Boundary Elements
International Journal for Numerical Methods in Engineering

Prerequisites by Topic:
1. Partial differential equations including Laplace’s equation and Fourier transform methods.
2. Elasticity
3. Topics in numerical methods including iso-parametric representations, numerical integration schemes and algorithms for linear algebraic systems

Course Objectives: This course will provide graduate students with the background necessary to implement the boundary element method (BEM) and will also provide a survey of some current topics in the BEM literature. The course will essentially be divided between topics in potential theory and elasticity. The thorough treatment of these two subject areas should provide a sufficient understanding of the method so that students may readily apply the BEM to model other physical problems such as wave propagation, free vibration analysis, etc. Presentation of computer simulation principles for injection molding and metal forming, solidification and residual stresses in manufacturing processes

Topics:
T1. Potential theory, fundamental solutions, direct and indirect methods and Green’s third integral identity (11 classes).
T2. Navier’s equation, Kelvin solution and Somigliana identities (9 classes).
T3. Boundary integral equations, integral interpretations and numerical implementation (6 classes).
T4. Regularization techniques (4 classes)
T5. Weighted residual statements (3 classes)
T6. Gradient formulations, degeneracy and related topics in numerical implementation (6 classes).
T7. Survey of research topics in the BEM such as fast summation methods, dual reciprocity, etc. (5 classes).
T8. Tests (2 classes)

Class Schedule: Three 50-minute sessions/week, total equivalent 46 sessions/semester

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