ORE 766 Numerical Analysis of Hydrodynamic Problems

Designation
Elective course

Catalog Description
Numerical methods for solving potential flow problems encountered in coastal and offshore engineering. Boundary element, finite difference, and finite element methods are used for the solution of initial-boundary-value problems. Prerequisite: Consent.

Prerequisites by Topics
Computer programming language
Basic numerical methods
Fluid mechanics
Water Wave Theory

Textbook
Notes by R. C. Ertekin and K. F. Cheung.

Reference Books
R. L. Burden et al., *Numerical Analysis*, Prindle, Weber & Schmidt, 1984.
K. H. Huebner, *Finite Element Method for Engineers*, John Wiley & Sons, 1975.
C. A. Brebbia et al., *Boundary Element Techniques*, Springer-Verlag, 1984.

Course Objectives
This course is designed to introduce graduate students into the numerical treatment of hydrodynamic problems.

Topics Covered
1. Review of basic numerical methods, difference calculus and numerical stability
2. Boundary Element Method (BEM)
3. Application of BEM to coastal and offshore engineering problems (steady state) that involve ocean structures
4. Finite Difference Method (FDM)
5. Application of FDM to water wave problems (unsteady state) in shallow channels of variable depth
6. Finite Element Method (FEM)
7. Application of FEM to various steady and transient fluid-body interaction problems
8. Comparison of the three numerical methods discussed

Usage of Engineering Tools and Computers
Write computer programs to solve partial differential equations with associated boundary and initial conditions. Use workstations and microcomputers.

Schedule
Two 1.25-hour sessions per week

Contribution to Professional Component
Engineering Science: 3 credits

Relationship to Program Outcomes
Program Outcome 2: Basic science, mathematics, & engineering
Program Outcome 6: Problem formulation & solution

Prepared by
R.C. Ertekin and K.F. Cheung, 1996