CE 308 COMPUTATIONAL ENGINEERING ANALYSIS

Co-ordinator: Dr. B.A. Izzuddin (Room 325), b.izzuddin@imperial.ac.uk

Status: Elective

Lecturers: Prof R.J. Sobey
Dr B.A. Izzuddin
Prof D.M Potts

Structure: 50 contact hours

Links: CE208, CE202, CE206, CE301, CE302, CE401, CE403, CE406

Aims

This course module provides an introduction to computational techniques applicable to solving real civil engineering problems in the fields of fluid mechanics, structures and geotechnics. Both the Finite Differences method and the Finite Element method are covered, with the students acquiring considerable practical experience through hands-on computer laboratory sessions.

SYLLABUS

Coursework/Matlab-focussed presentation (RJS)

1. Introduction to MATLAB
2. Implicit algebraic equations. Applications such as Colebrook-White, normal depth, pipe systems.
3. Ordinary Differential Equations. Applications such as pipe networks, gradually-varied channel flow.
4. Initial Value Problems in Partial Differential Equations. Alternatives (Finite Difference, Finite Volume, Finite Element, Method of Lines). Presented in context of unsteady contaminant transport.

Finite element analysis (BAI)

1. Problem discretisation using finite elements.
2. Assembly and solution of discrete model equations.
3. Two dimensional finite elements, with emphasis on plane stress/plane strain and plate bending elements.
4. Error estimation for linear analysis.
5. Application to structural engineering problems.

Finite element analysis in geotechnical engineering (DMP)

1. Nonlinear solution strategies-tangent stiffness, visco-plastic and Newton Raphson approaches.
2. Implicit and explicit stress point schemes.
3. Coupled analysis – mechanical and pore fluid flow.
4. Boundary conditions – construction, excavation, tied freedoms, infiltration, precipitation etc…
5. Application to geotechnical problems.

Recommended Textbooks

1. HOFFMAN, JD (2001) Numerical Methods for Engineers and Scientists, Dekker, New York.
2. PRATAP, R (2002), Getting Started with MATLAB, Oxford university Press.
3. MOAVENI, S, 'Finite Element Analysis: Theory and Application with ANSYS', Prentice Hall, New Jersey.
4. POTTS, DM & ZDRAVKOVIC, L, (1999), Finite element analysis in geotechnical engineering: theory, Thomas Telford, London.
5. POTTS, DM & ZDRAVKOVIC, L, (2001), Finite element analysis in geotechnical Engineering: application, Thomas Telford, London.