OCP6167 Nonlinear Waves

Class MWF 8 (3:00 PM, Coastal Conf. Room)
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Course Outline

1 Linear Waves.

Surface Gravity Waves: Governing equations. Linearization - small amplitude waves. Linear wave solution for slowly varying topography. Kinematics. Dynamics.

Dispersive Waves: Dispersion relation. Wave geometry and dynamics. Model Equations: Boussinesq, KdV, Schrodinger.

2 Nonlinear Waves.

Examples: Stokes waves. Solitary & cnoidal waves. Shallow water waves. Bore formation. Nonbreaking waves on a beach. Three-wave interactions.

Weak Turbulence: Zakharov and Hasselmann Equations. Resonance. Nonlinear shoaling.

Large Amplitude Waves: Wave breaking. Freak (Rogue waves).

3 Applications.

Deep water wave forecasting. Nonlinear shoaling. Harbour resonance.

Prequisites

Basic fluid mechanics; Ordinary differential equations; Orthogonal functions and harmonic analysis; Basic linear algebra; Linear waves.

These topics will be used and ocasionally discussed in the course but will not be reviewed systematically. Familiarity with these topics is required.

Grading

20% Class participation.
30% Homework.
50% Final project.

Basic Texts

Crapper, G.D., *Introduction to Water Waves*, Ellis Horwood, John Wiley & Sons, 1984.

Mei, C.C., M. Stiassnie, and D. K.-P. Yue, *Theory and Applications oif Ocean Surface Waves*, Advanced Series on Ocean Engineering, World Scientific, 2005.

Whitham, G.B., *Linear and Nonlinear Waves*, Pure and App. Mathematics, Wiley-Interscience, 1974.