Unsteady Body Motion, Wave-Structure Interaction, Wave Energy Extraction, Forward-Speed Effects, Hydrofoil Theory

TuTh 12:30-14:00, 3113 Etcheverry
Prerequisite: ME106, or CE100, or Seniors Standing
ME241A – not required

Course Syllabus

A. Unsteady Body Motion in an Infinite Fluid

General formulation & moving frame of reference
Unsteady hydrodynamic forces and moments
Kirchoff's decomposition, added mass theory
Solution representation by singularity distribution
Steady versus unsteady flows about bodies
Empirical modeling of viscous effects

B. Body Motion in Waves and Ocean Energy

Coordinate systems and general consideration
Linearization of body boundary condition
Mode decomposition in time-harmonic problems
Hydrodynamic forces and moments
Added masses and damping matrices
Radiation and diffraction potentials; examples
Hydrostatics, body inertia, and equations of motion
Response characteristics
Forward-speed effects and ship-motion theory
Reciprocity Relations
Wave-energy extraction principles
Energy devices and analysis

C. Hydrofoil Theory

Complex variables, complex potential, conformal mapping
Blasius theorem, circle theorem, circulation
Two-dimensional thin-wing theory
Thickness and Lifting problems, Applications
Vortex theorems in three dimensions
Three-dimensional wings, lifting-line theory
Induced drag, Circulation Distribution
Cavitating Flows.

Homework problems: (50%), Midterm-Quiz: (15%)
Final Exam: Either 1-hour oral or 3-hour written (35%)
Textbook & references: Lecture-Notes & Handouts,

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