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IN THE SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY AT THE UNIVERSITY OF HAWAI'I AT MĀNOA

Hydrodynamic and Structural Analysis of Ships and Offshore Platforms

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Monday, Nov 20

2:30 – 3:00 pm Coffee

3:00 - 4:00 pm Seminar

Abstract

Evaluating the hydrodynamic and structural response of ships and offshore platforms is an important part of the overall design process. This is true for both extreme stress responses and the fatigue life of the hull structural details. Hydroelasticity, which deals with the dynamic interactions between elastic structures and ocean waves, is an important consideration in the design of modern ships because of increased hull flexibility and higher speeds. In this respect a hydroelasticity analysis method for ships is presented in the frequency domain that accounts for the effects of forward speed. The method is based on the Rankine source hydrodynamic formulation describing the potential flow and the resulting pressure on the hull wetted surfaces. A translating coordinate system is adopted which accounts for the Doppler shift of scattered waves due to forward vessel motion. The hydrodynamic forces from waves are directly coupled to a dynamic finite element model of the hull structure leading to hull deformations and stresses. The numerical model is applied to a bottom-mounted fluid-filled membrane system in waves and an advancing Wigley hull form. The numerical model predictions are validated by comparisons with laboratory experiments and with predictions from the standard modal superposition structural analysis method. Some examples of hydrodynamic analysis of conceptual, new-build and existing offshore platforms are also presented, highlighting the challenges involved in the numerical modeling and focus for future research.

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