Air-Sea Interaction, Faraday Waves and Hydrodynamic Stability

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LONG-TERM GOALS

My research is directed toward primarily understanding wave generation and wave motion in the ocean and in laboratory simulations thereof.

OBJECTIVES

See **LONG-TERM GOALS** above.

APPROACH

My primary approach is through mathematical models. Solutions ultimately are developed in both analytical and numerical form, but my goal is to obtain analytical results that inform phenomenological models for the prediction of physical events.

WORK COMPLETED

(Completed and reported in FY01 but published in FY02.)

[1] J. Miles, "A note on surface waves generated by shear-flow instability" *J. Fluid Mech*. **447**, 173-17 (November, 2001).

[2] J. Miles, "On slow oscillations in coupled wells" *J. Fluid Mech.* **455**, 283-287 (March, 2002).

[3] J. Miles, "On resonant reflection by a plane grating" *Wave Motion* **35**, 311-314 (April, 2002).

[4] J. Miles, "Gravity waves in a circular well" *J. Fluid Mech*. **460**, 177-180 (June, 2002).

I have carried out a preliminary, analytical calculation of nonlinear Faraday waves with a fixed contact line in anticipation of experimental work to be carried out by Dr. Diane Henderson (Penn State). This work remains to be checked, and it may be necessary to resolve an apparent singularity.

RESULTS

[1] revisits Morland, Saffman & Yuen's study of the stability of a semi-infinite, concave shear flow bounded above by a capillary-gravity wave, for which they obtained numerical solutions of Rayleigh's equation. A variational formulation is used to construct an analytical description of the unstable modes.

[2] formulates the eigenvalue problem for slow oscillations of a liquid in a set of N wells that are bounded above by free surfaces and below by a common reservoir. Detailed solutions are obtained for a pair of identical circular wells. The results are of practical interest in connection with marine operations and artesian wells.

[3] determines the resonant minimum of the transmission coefficient of an infinite, periodic, plane grating for normal incidence of a plane wave. The results are applicable to both acoustic and surface waves.

[4] derives the resonant frequencies of the non-Helmholtz sloshing modes in a circular well that is bounded above by a free surface and below by a reservoir directly from the corresponding results for an aperture in a half-space (well of zero depth). The resonant frequency for the Helmholtz mode is determined separately. The results are applicable to "moon pools" in oil-drilling ships (Molin 2001) and artesian wells.

IMPACT/APPLICATIONS

The results in [1] and [3] are applicable to coastal engineering and naval operational problems. The results in [1] contribute to our understanding of air-sea interaction. The results in [2] and [4] are relevant to well bays in drilling ships.

TRANSITIONS

RELATED PROJECTS

PUBLICATIONS

See **WORK COMPLETED**.