Abstract Submitted
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Experimental Observation of Modulational Instability in Crossing Surface Gravity Wavetrains[1] JAMES N. STEER, The University of Edinburgh, MARK L. MCALLISTER, University of Oxford, ALISTAIR G. L. BORTHWICK, The University of Edinburgh, TON S. VAN DEN BREMER, University of Oxford — The coupled nonlinear Schrödinger equation (CNLSE) is a wave envelope evolution equation applicable to two crossing, narrow-banded wave systems. Modulational instability (MI), a feature of the nonlinear Schrödinger wave equation, is characterized (to first order) by an exponential growth of sideband components and the formation of distinct wave pulses, often containing extreme waves. Linear stability analysis of the CNLSE shows the effect of crossing angle, θ, on MI, and reveals instabilities between $0^\circ < \theta < 35^\circ$, $46^\circ < \theta < 143^\circ$, and $145^\circ < \theta < 180^\circ$. Herein, the modulational stability of crossing wavetrains seeded with symmetrical sidebands is determined experimentally from tests in a circular wave basin. Experiments were carried out at 12 crossing angles between $0^\circ \leq \theta \leq 88^\circ$, and strong unidirectional sideband growth was observed. This growth reduced significantly at angles beyond $\theta \approx 20^\circ$, reaching complete stability at $\theta = 30$–40°. We find satisfactory agreement between numerical predictions (using a time-marching CNLSE solver) and experimental measurements for all crossing angles.

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James N. Steer
The University of Edinburgh

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