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Rogue Wave Modes for the Long Wave-Short Wave Resonance and the Derivative Nonlinear Schrödinger Models[1] HIU NING CHAN, KWOK WING CHOW, The University of Hong Kong, DAVID JACOB KEDZIORA, Australian National University, ROGER HAMILTON JAMES GRIMSHAW, Loughborough University, EDWIN DING, Azusa Pacific University
— Rogue waves are unexpectedly large displacements of the water surface and will obviously pose threat to maritime activities. Recently, the formation of rogue waves is correlated with the onset of modulation instabilities of plane waves of the system. The long wave-short wave resonance and the derivative nonlinear Schrödinger models are considered. They are relevant in a two-layer fluid and a fourth order perturbation expansion of free surface waves respectively. Analytical solutions of rogue wave modes for the two models are derived by the Hirota bilinear method. Properties and amplitudes of these rogue wave modes are investigated. Conditions for modulation instability of the plane waves are shown to be precisely the requirements for the occurrence of rogue waves. In contrast with the nonlinear Schrödinger equation, rogue wave modes for the derivative nonlinear Schrödinger model exist even if the dispersion and cubic nonlinearity are of the opposite signs, provided that a sufficiently strong self-steepening nonlinearity is present. Extensions to the coupled case (multiple waveguides) will be discussed.

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