Abstract Submitted
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Utilizing a Coupled Nonlinear Schrödinger Model to Solve the Linear Modal Problem for Stratified Flows[1] TIANYANG LIU, HIU NING CHAN, The Univ of Hong Kong, ROGER GRIMSHAW, University College London, KWOK WING CHOW, The Univ of Hong Kong — The spatial structure of small disturbances in stratified flows without background shear, usually named the 'Taylor-Goldstein equation', is studied by employing the Boussinesq approximation (variation in density ignored except in the buoyancy). Analytical solutions are derived for special wavenumbers when the Brunt-Väisälä frequency is quadratic in hyperbolic secant, by comparison with coupled systems of nonlinear Schrödinger equations intensively studied in the literature. Cases of coupled Schrödinger equations with four, five and six components are utilized as concrete examples. Dispersion curves for arbitrary wavenumbers are obtained numerically. The computations of the group velocity, second harmonic, induced mean flow, and the second derivative of the angular frequency can all be facilitated by these exact linear eigenfunctions of the Taylor-Goldstein equation in terms of hyperbolic function, leading to a cubic Schrödinger equation for the evolution of a wavepacket. The occurrence of internal rogue waves can be predicted if the dispersion and cubic nonlinearity terms of the Schrödinger equations are of the same sign.

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