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Numerical solution of internal-wave systems in the intermediate long-wave and Benjamin-Ono regimes.

Considered in this talk are two systems modeling the two-way propagation of long crested, long-wavelength internal waves along the interface of a two-layer system of fluids in the Benjamin-Ono and the Intermediate Long-Wave regimes, respectively. These systems were shown to have solitary-wave solutions, decaying to zero algebraically, in the Benjamin-Ono regime, and exponentially in the Intermediate Long-Wave regime. Several methods to approximate the solitary-wave profiles are introduced and analyzed in the first part of the talk. A natural continuation is to study the dynamics of these solitary waves. This will be done by computational means from the discretization of the periodic initial-value problem. The numerical method used here is a Fourier spectral method for the spatial approximation coupled with a fourth-order, explicit Runge-Kutta method in time. We first prove error estimates of the semidiscretization in space. The resulting fully discrete scheme is then used to study computationally the stability of the solitary waves under small and large perturbations, the collisions of solitary waves, the resolution of initial data into trains of solitary waves, and the formation of dispersive shock waves. Comparisons with related unidirectional models are also made.

This is a joint work with Jerry L. Bona (University of Illinois at Chicago) and Dimitrios Mitsotakis (Victoria University of Wellington).