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*Interaction between long internal waves and free surface waves in deep water*

We present a study of the two-dimensional water wave problem consisting of a density-stratified fluid composed of two immiscible layers separated by a sharp interface. A goal is to describe the interaction between long, larger amplitude, nonlinear waves on the interface and modulated, smaller amplitude, free wave packets on the surface when the lower fluid is infinitely deep. In the first part, starting from the Hamiltonian formulation of this problem and using techniques from Hamiltonian transformation theory, we describe the resonant interaction of the waves by a system of equations where the internal wave solves a high-order Benjamin-Ono equation coupled to a linear Schroedinger equation for the time evolution of the wave envelope of the free surface. In the second part, we establish a local well-posedness result for the BO-Schroedinger system in the physical regime where the densities of the two fluid layers are close. Neglecting the higher-order coupling terms, we perform a gauge transformation to eliminate the higher-order non-linear terms and reformulate our BO equation, from which our proof follows by a fixed-point argument. This is a joint work with A. Kairzhan and C. Sulem.