Abstract

The properties of fully three-dimensional gravity waves propagating on the interface between two finite layers of different densities are investigated. Solutions are calculated via a computer-generated perturbation expansion in wave steepness. Series solutions are analytically computed to third-order for general wave parameters, and numerically to 27th-order for five specific values of μ=0,0.001,0.1,0.5 and 0.99, where μ is the ratio of the density of the upper fluid to that of the lower fluid. For near limiting waves, the series of frequency, kinetic energy and potential energy are summed using Pad approximants. For both two and three-dimensional cases, the present theory is found to coincide with previous theories such as two-dimensional interfacial standing waves, two-dimensional interfacial progressive waves and three-dimensional surface gravity waves respectively, showing the validity and general applicability of the solutions. The numerical results demonstrate the influence of the ratio density and thicknesses of the two fluids on the wave profile and wave frequency bifurcation. Particular attention is paid to the harmonic resonances where multiple solutions are possible