Soliton dynamics in the Korteweg-de Vries (KdV) equation with step-like boundary conditions

The Korteweg-deVries (KdV) equation with step-like boundary conditions is considered, with an emphasis on soliton dynamics. When one or more initial solitons are of sufficient size, they can propagate through the step; in this case, the phase shift is calculated via the inverse scattering transform. On the other hand, when the amplitude is too small, they become trapped, and the corresponding eigenvalues of the Schrödinger equation are embedded in the continuous spectrum. The above results are confirmed numerically. For small dispersion, the above dynamics are described by perturbation theory. Our analytical results agree with laboratory experiments.