Application of the theory of differential equations and spectral analysis to the study of trapped topographic waves

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We conduct the mathematical simulation of trapped topographic waves in order to study nonlinear effects by the propagation of these waves. The system of hydrodynamic equations for the wave perturbations is solved by the asymptotic method of multi-scale expansions: solutions of linear approximation are found for the first-order smallness of the slope of the wave. The uniform boundary-value problem of Sturm-Liouville type is solved numerically and the eigenfunctions and the eigenvalues (the square of the wave number) for the trapped topographic waves are obtained. The average flows, induced by the wave due to the nonlinearity, are determined for the second-order smallness of the slope of the wave. The nonlinear Schrödinger equation for the envelope of the wave is obtained and we make a conclusion about the modulation instability of the trapped topographic waves.