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Forced solitary waves over complex topography

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In present paper we consider the problem on solitary waves forced by a chain of gently sloped obstacles of small height. Steady two-dimensional free-surface flows over a complex topography are studied analytically in the case when the far upstream flow is slightly supercritical. Small height- and steepness restrictions are important here since these circumstances provide the balance between nonlinear dispersion and hydraulic effects both affecting nearly hydrostatic non-uniform flow. Fully non-linear irrotational Euler equations are formulated via the von Mises transformation that parametrizes the family of streamlines in a curvilinear flow domain. It is well known that the critical value of the Froude number is the bifurcation point providing non-uniqueness of stationary flow. In present work, we construct and analyze approximate solitary-wave solutions by using long-wave expansion procedure with two small parameters. In addition, we apply the Lyapunov - Schmidt method which ensures an analytical condition of the wave-trapping formulated in terms of the Melnikov function. A specific class of multi-bumped topographies is considered in order to demonstrate multiplicity of forced waves. The amount of different wave regimes depends on the number of bumps and pits, as well as on their location and size in relation to each other.