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Generation Solitary Waves for Viscous Flow over a Hole

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Abstract : This study investigates the transcritical flow of a stratified fluid over topography under negative forcing amplitude (hole), which generates upstream and downstream flows connected by an unsteady solution. This phenomenon is formulated by a forced Korteweg-de Vries–Burgers model, considering weak nonlinearity and weak dispersion by accounting for the fluid's viscosity beyond the Korteweg–de Vries approximation. The findings highlight that viscosity significantly affects various wave characteristics, such as the amplitudes of solitary waves both upstream and downstream, as well as the widths of the bores. We focused here on weak damping, and the results apply to transcritical, supercritical, and subcritical flows. Generally, when the viscosity is low, the results differ qualitatively from those predicted by the forced Korteweg-de Vries equation, with notable variations arising as viscosity increases.

Keywords : Korteweg-de Vries-Burgers' equation, soliton, viscous flow, transcritical (resonant) flow, solitary waves
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