MULTI-SOLITON INTERACTIONS OF FORCED KORTEWEG de VRIES EQUATION WITH TIME-VARYING FROUDE NUMBER

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Abstract. Transcritical flows over uneven bottom topography are investigated, in the framework of the forced Korteweg de Vries (fKdV) equation. Pseudo-spectral method will be used to solve fKdV equations numerically to observe the effect of Froude number, especially for long time simulation. When the Froude number is constant, there is no collision between the uniform solitons due to the same amplitudes and speeds. However, two sets of solitary waves travelling upstream were discovered numerically when the Froude number varies. Various interaction patterns of the propagating upstream solitary waves which create a pairwise and two pairwise interactions were observed in the transcritical regime and are presented in various graphical outputs.

Keywords. Soliton; Forced soliton; Forced Korteweg de Vries equation; Pseudo-spectral; Transcritical; Uneven bottom topography

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1 Introduction

Transcritical flows over uneven bottom topographies have been a hot research for the last three decades due to its physically rich and mathematically tractable phenomena of a nonlinear dispersive system, which extends a linear resonance condition. It is still difficult to fully understand the flow over obstacles, especially in the atmosphere or oceans, due to various conditions. Typical factors that control the phenomena are the uneven bottom topography and the time-varying upstream flow speed [1]. The effects of transcritical flow over uneven bottom topography are important, due to the circumstances of the physical effect which can cause a forcing effect. Common examples are