WELL BALANCED SCHEME BETWEEN FLUX AND SOURCE TERMS FOR THE COMPUTATION OF SHALLOW-WATER EQUSTIONS

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Abstract

A simple and robust computational scheme for the analysis of shallow water equations with source terms is proposed. The shallow equations solved by approximate Riemann solvers are good for the analysis of subcritical, supercritical, continuous and discontinuous flows. Moreover, various robust numerical techniques including the numerical scheme for the Euler equations can be exploited. However, the merits are limited to only idealized cases because the numerical unbalance between the flux terms and source terms. Thus, a revised surface gradient method is developed considering the balance between flux and source terms. The MUSCL-Hancock scheme and HLLC approximate Riemann solver were used for developing the numerical model. Several cases including steady transcritical flows and unsteady dam break flows on wet and dry bed were tested. Very good agreements were observed.

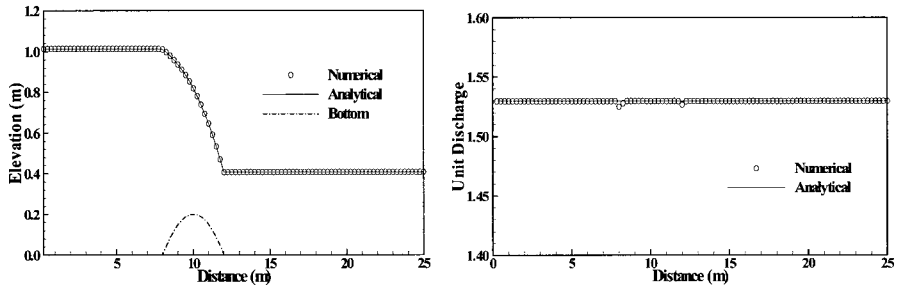
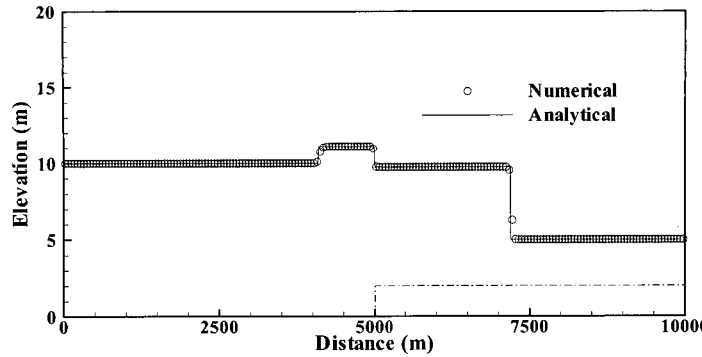
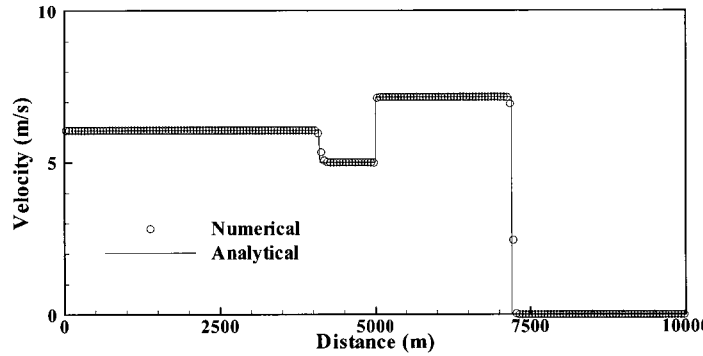


Fig. 1 Transcritical flow tests

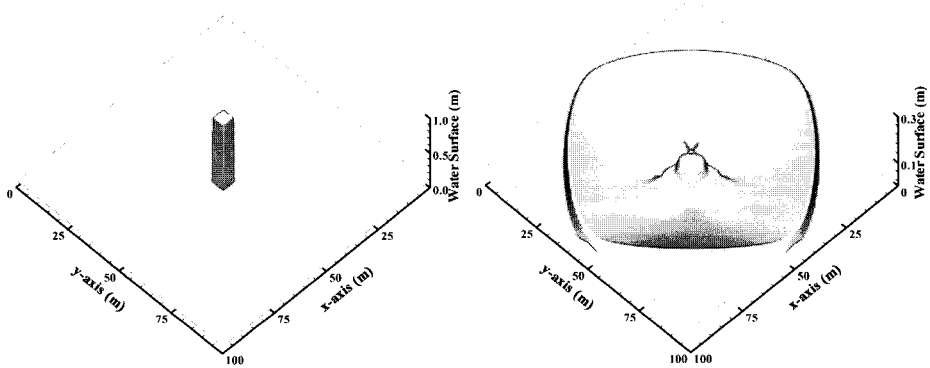


(a) Water surface



(b) Velocity

Fig. 2 Test of surge wave crossing a vertical step.



(a) t = 0.0 second (b) t = 25.0 second

Fig. 3 Computed water surface profile (two-dimensional ideal dam break flow test).