

A model for mobile-bed, free-surface flows in arbitrary cross-sections

ALBERTO DEPONTI - *University of Trento*

The model we propose and analyse is based on the conservation equations of liquid mass, solid mass and momentum. The three equations are reduced to one dimension by averaging over the cross-section. These equations differ from the classical one-dimensional equations for mobile-bed, free-surface flows since they take into account the effect of non-uniformities in velocity distribution along arbitrary cross-sections. By using appropriate closure formulas for sediment transport and for bottom friction, a system of three non-linear hyperbolic equations is obtained. The three system unknowns are surface and bed elevations and discharges. In most real cases flow dynamics and morphological evolution of the base are coupled; in this work a section-averaged coupled model is presented and analysed. In particular, the characteristics of this model are studied and compared to those of classical one-dimensional models in order to investigate how the non-uniformities along arbitrary cross-sections influence the eigenstructure of the system of equations. Finally, a Semi-Implicit Finite Volume formulation for the numerical solution of the equations is presented; in this formulation part of the non-linearity of the system is retained in order to guarantee mass conservations in arbitrary cross-sections.