THREE-EQUATION METHOD IN SOLVING ONE DIMENSIONAL UNSTEADY OPEN CHANNEL FLOW

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ABSTRACT

In one dimensional unsteady open channel flow, the de St. Venant hypotheses are utilized to describe the unsteady behavior for the discharge and water depths in the flow domain. One of the de St. Venant hypotheses is that the friction force in the iongitudinal momentum equation (dynamic equation) is described by uniform flow empirical relation, which involves the local unknow variables (discharge and water depth). Therefore, the numerical model based on Pressimann scheme needs further cares to make the solutions convergent.

In this study, a new method by treating the friction slope, S_f, as the third dependent variable with a third equation in solving for the problem is proposed. To utilize the empirical friction force relation as the third equation with time dependence makes the system of equations complete and enables the time dependent local friction slope, S_f, to be calculated directly. The direct computation of St at various time steps eliminates the necessity of iterations while two-equation method (continuity and dynamic equations) with two dependent variables is used in solving for the problem.