



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Linearized Saint-Venant Equations in Various Forms with Lateral Inflow in a Channel of Finite Length

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SHORT ABSTRACT

de Saint-Venant introduced a system of two first-order partial differential equations to study the one-dimensional, gradually varied, unsteady flow in an open channel. These equations, called Saint-Venant equations or dynamic wave models, are mathematical descriptions of the conservation of mass and momentum. Due to the nonlinear momentum equation, an analytical solution for the full form of these equations is not available yet. It has some popular simplified forms: the most widely used simplified models are kinematic and diffusive wave models. The kinematic wave model is the most simplified form, but it cannot consider the effect of the downstream boundary condition. The diffusive wave model is derived by ignoring the effect of the inertial forces, and it is the most widely used model in channel routing since it considers the downstream boundary condition and the backwater effect. Our work is focused on finding approximate solutions for the dynamic and diffusive wave models in a channel of finite length by including several types of lateral inflow. The solutions for the flow discharge and flow depth are proposed as a function of space and time. Laplace transform method is used to find the solutions. The inverses of the Laplace transforms are derived by using either the Laplace inversion theorem or some direct formulas. The behavior of the flow discharge and flow depth is thoroughly discussed for diverse types of upstream and downstream boundaries and several types of lateral inflows with respect to the physical parameters used in the study. The influence of the downstream boundary and the lateral inflow on the behavior of the flow depth along the channel is more significant as compared to that of the flow discharge.