

## **Boundary Conditions Effect on Linearized Mud-Flow Shallow Model**

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### **A b s t r a c t**

The occurrence of roll-waves in mud-flows is investigated based on the formulation of the marginal stability threshold of a linearized one-dimensional viscoplastic (shear-thinning) flow model. Since for this kind of non-Newtonian rheological models this threshold may occur in a hypocritical flow, the downstream boundary condition may have a non-negligible effect on the spatial growth/decay of the perturbation. The paper presents the solution of the 1D linearized flow of a Herschel and Bulkley fluid in a channel of finite length, in the neighbourhood of a hypocritical base uniform flow. Both linearly stable and unstable conditions are considered. The analytical solution is found applying the Laplace transform method and obtaining the first-order analytical expressions of the upstream and downstream channel response functions in the time domain. The effects of both the yield stress and the rheological law exponent are discussed, recovering as particular cases both power-law and Bingham fluids. The theoretical achievements may be used to extend semi-empirical criteria commonly employed for predicting roll waves occurrence in clear water even to mud-flows.

**Key words:** boundary conditions, Herschel and Bulkley fluid, linear stability, roll-waves, shallow flow model.