SCREENING EFFECTS ON NEWTONIAN FLUID FLOW IN OPEN CHANNELS WITH PERIODIC ROUGHNESS

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Flow through rough channels has been described for two decades. This type of flow in closed channels can be partially explained by Makarov's Theorem as Araújo, Andrade Jr and Sapoval described. The distribution of the shear stress in the channel walls seems to obey the Theorem in the flow regime in which the inertial effects are not important. Interestingly, civil engineers have constructed saw-shaped weir spillways to predict the points where the shear stress is greatest, such that these points are reinforced. In this work, we numerically and experimentally study the flow of fluids through open channels (Hele-Shaw flow) with periodic roughness propelled by the action of gravity. We use sinusoidal functions and step functions as profiles. We solved the continuity and Navier-Stokes equations in the transient regime for the two-phase flow with no-slip conditions on the walls and with constant slope θ. We were able to show the relationship between the roughness period λ and the spillway flow rate Q, presenting an optimal period for different flows. We determine the maximum stress points and define a function of the distribution of the harmonic measurement in the channel wall. We relate the stress distribution to the average height of the fluid at the spillway.