



## **Laboratory Hydraulic Investigation of Steep Plane Bed Streams Using Large Scale Particle Image Velocimetry**

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Flow hydrodynamics of steep mountain streams is not yet satisfactorily known. The presence of large isolated roughness elements with a height comparable to flow depth precludes utilization of conventional flow resistance equations normally developed for lower gradient streams. Since in steep channels a large portion of the shear stress is borne by macro roughness elements it is essential to go for approaches that take this fact into consideration. In this research we investigate hydrodynamics of flow in high gradient gravel bed streams under different channel slopes, packing densities, relative submergence of the roughness elements and ratios of macro roughness element size to bed material size. For this purpose, we use uniform size glass beads and bigger spherical obstacles to represent gravel bed and large roughness elements, respectively. Large Scale Particle Image Velocimetry is utilized to obtain 2D velocity vector field in order to study the effect of experiment variables on surface flow structure. This investigation provides more insight into the nature of flow in steep plane bed channels in the presence of macro roughness elements.