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Application of Entropy Concept for Discharge Estimation: An Experimental Investigation in a Laboratory Flume

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Abstract : River flow measurement is an essential practice in hydraulic engineering for water resources planning and management, water availability analysis, flood forecasting. However, conventional methods (Prandtl-Von Karman law and power-law) of discharge measurement are costly, time-consuming, cumbersome, dangerous during high floods and rough weather. These laws are valid for wide-open channels only. Considering the limitations of traditional methods, Chiu (1987) presented the probability approach for finding velocity distribution at a river section with the help of the principle of maximum entropy, which provides better results in numerous situations like sediment-laden flows. The entropy theory relies on an entropy parameter which remains constant in different conditions of flow. Hence, it can be surmised as an intrinsic parameter. Experimental investigations on laboratory flume under controlled conditions were conducted to collect precise data at different discharge rates to record corresponding velocity distribution data, which was used to apply the concept of entropy theory for estimating the entropy parameter and discharge. Analysis of the collected data depicts that the entropy parameter remains constant with varying discharge rates. Results obtained based on analysis of collected data revealed that the two-dimensional entropy model was a quick and accurate technique for estimation of mean cross-sectional velocity and discharge.

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