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Estimation of Bed Material Load using Artificial Intelligence Techniques

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Estimation of sediment transport has significant implementation on water resources and hydraulic engineering. Transport of sediment is affected by flow and sediment properties and also climatic variation of the region. To examine the behaviour of sediment transport, wide range of experiments have been performed in laboratories. Most of the developed sediment transport formulations are empirical or semi empirical in nature. These days, the development of computer-aided programs such as MATLAB has opened the way for researchers to quickly study the generation mechanism. The “Artificial Neural Networks (ANN) and Adaptive Neuro-Fuzzy Inference System (ANFIS)” can be used widely for developing sediment model. In this research, Feed Forward Back Propagation (FFBP) sort of ANN and Hybrid type based on the Sugeno approach of ANFIS is used to develop a model for bed material load transport using parameters like “channel discharge, width of the channel, flow depth, friction/energy slope, mean size of sediment, bed shear stress, critical shear stress, gradation coefficient of the sediment particles, specific gravity, and viscosity”. Subsequently, the relationship between the expected and observed values is presented. The proposed approach showed superior results based on various statistical parameters, like the coefficient of determination (R^2), Nash-Sutcliffe coefficient (NSE), Root mean square error (RMSE) and Mean absolute error (MAE). Correlation (R^2), higher than (~ 0.90) indicates that ANN and ANFIS are compatible and capable of measuring the total bed material load.

Keywords: Sediment transport, Bed material Load, ANFIS, ANN, FFBP