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Development of group method of data handling based on genetic algorithm to predict incipient motion in rigid rectangular storm water channel

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Group Method of Data Handling (GMDH);
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Sediment transport;
Storm water.

Abstract. Sediment transport is a prevalent vital process in fluvial and coastal environments, and "incipient motion" is an issue inseparably bound to this topic. This study utilizes a novel hybrid method based on Group Method of Data Handling (GMDH) and Genetic Algorithm (GA) to design GMDH structural (GMDH-GA). Also, Singular Value Decomposition (SVD) was utilized to compute the linear coefficient vectors. In order to predict the densimetric Froude number (Fr), the ratio of median diameter of particle size to hydraulic radius (d/R) and the ratio of sediment deposit thickness to hydraulic radius (t_s/R) are utilized as effective parameters. Using three different sources of experimental data and GMDH-GA model, a new equation is proposed to predict incipient motion. The performance of development equation is compared using GMDH-GA and traditional equations . The results indicate that the presented equation is more accurate ($RMSE = 0.18$ and $MAPE = 6.48\%$) than traditional methods. Also, a sensitivity analysis is presented to study the performance of each input combination in predicting incipient motion.

1. Introduction

Urban drainage systems, commonly used to transport storm water runoffs, are capable of easily transporting storm water runoffs, but sedimentation can occur after a specific period of time. Sedimentation in the urban drainage system leads to reduction in the hydraulic capacity of the drain, which in return can cause flash flooding [1]. One of the essential issues in sediment transport is determining the minimum velocity needed in order for the sediment to start to transport from a stagnant state (incipient motion). Therefore, it is crucial to fully understand the definition of "initial velocity" in designing urban drainage systems. It can be stated that generally the initial velocity occurs when the flow around the particle is more powerful than the resistance force of the particle weight [2]. So, "incipient motion" occurs when the calculated shear stress is greater than the critical shear stress of the bed substances in the channel.

Evaluating the flow conditions that produce incip-

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