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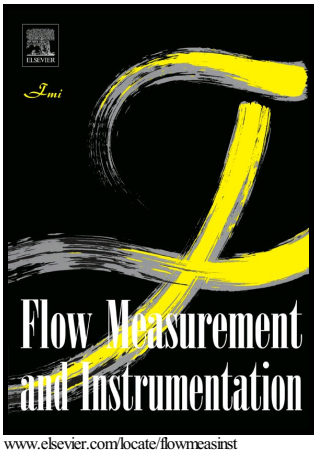

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PII: S0955-5986(16)30136-4
DOI: https://doi.org/10.1016/j.flowmeasinst.2017.12.006
Reference: JFMI1390

To appear in: *Flow Measurement and Instrumentation*

Received date: 7 September 2016
Revised date: 27 November 2017
Accepted date: 11 December 2017

Cite this article as: Kiyoumars Roushangar, Samira Akhgar and Farzin Salmasi, Estimating Discharge Coefficient of Stepped Spillways under Nappe and Skimming Flow Regime using data driven approaches, *Flow Measurement and Instrumentation,* https://doi.org/10.1016/j.flowmeasinst.2017.12.006

Estimating Discharge Coefficient of Stepped Spillways under Nappe and Skimming Flow Regime using data driven approaches

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Abstract

An important step toward spillways design always involves appropriate determination of the discharge coefficient. Since existing equations are incapable of estimating the discharge coefficient of stepped spillway accurately, other approaches such as data driven techniques can be employed as an alternative which are useful in modeling processes when the physical knowledge is limited. For this purpose, Gene Expression Programming (GEP) and Support Vector Machine (SVM) as data driven methods were applied for the modeling discharge coefficient of the stepped spillways using data derived from physical models and original experiments under nappe and skimming flow regimes. The input parameters included different dimensionless geometric and hydraulic parameters of napped and skimming regimes data. The obtained results indicated that the applied methods have a high capability in the modeling of discharge coefficient for the stepped spillways. The model comprised of four input parameters used for modeling of the discharge coefficient in nappe flow showed more accurate results (%RMSE=0.042, 0.328 and R^2=0.966, 0.961 for the SVM and GEP models, respectively). In skimming flow data, the model with five input parameters produced RMSE=0.015, 0.357 and R^2 =0.987, 0.979 in SVM and GEP, respectively. A comparison of the GEP and SVM results with the obtained results from the Multiple Linear Regression (MLR) showed that the performance of the linear model (i.e., MLR) was not suitable because the phenomenon of discharge coefficient is inherently complex and nonlinear. The results of sensitivity analysis for both proposed methods