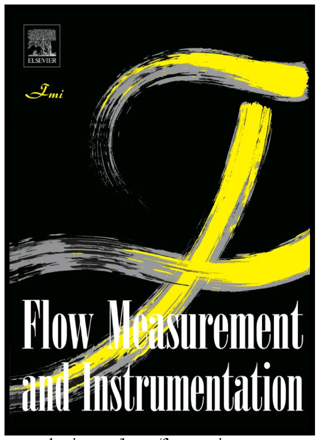
Author's Accepted Manuscript



www.elsevier.com/locate/flowmeasinst

Predicting Discharge Coefficient of Triangular Labyrinth Weir Using Support Vector Regression, Support Vector Regression-firefly, Response Surface Methodology and Principal Component Analysis

Hojat Karami, Sohrab Karimi, Mohammad Rahmanimanesh, Saeed Farzin

PII: S0955-5986(16)30263-1
DOI: http://dx.doi.org/10.1016/j.flowmeasinst.2016.11.010
Reference: JFMI1294

To appear in: *Flow Measurement and Instrumentation*

Received date: 25 April 2016
Revised date: 19 November 2016
Accepted date: 30 November 2016

Cite this article as: Hojat Karami, Sohrab Karimi, Mohammad Rahmanimanes and Saeed Farzin, Predicting Discharge Coefficient of Triangular Labyrinth Wei Using Support Vector Regression, Support Vector Regression-firefly, Response Surface Methodology and Principal Component Analysis, *Flow Measuremen and Instrumentation,* http://dx.doi.org/10.1016/j.flowmeasinst.2016.11.010

Predicting Discharge Coefficient of Triangular Labyrinth Weir Using Support Vector Regression, Support Vector Regression-firefly, Response Surface Methodology and Principal Component Analysis

Hojat Karami[a], Sohrab Karimi[b*], Mohammad Rahmanimanesh[c], Saeed Farzin[d]

[a, b, d] *Department of Civil Engineering, Semnan University, Semnan, Iran*

[c] *Faculty of Electrical and Computer Engineering, Semnan University, Semnan, Iran*

[*] *Corresponding author: e-mail: m.karimi@semnan.ac.ir,Phone: (+98) 918-333-5727*

Abstract

Weirs are hydraulic structures which conduct the most powerful flow with large overflow. Discharge flow predication is based on capacity discharge designation by designer. In this paper, the discharge capacity in triangular labyrinth side-weirs is computed by using new techniques with high precision. The four employed techniques for computation of discharge capacity are: Support Vector Regression (SVR), Support Vector Regression–Firefly (SVR- Firefly), Response Surface Methodology (RSM) and Principal Component Analysis (PCA).A comparison between the computed discharge capacity and empirical results is considered in this paper. Determination coefficient ($R^{2)}$, Root Mean Square Error (RMSE), Mean Absolute Percentage Error (MAPE), SI and δ are five statistical indicators which help us to measure the precision of the designed models. The statistical indices indicated that the SVR-Firefly model has the highest ability among the models for simulation, with average MAPE=0.49%, R^2=0.991 and RMSE=0.0035. Like the results achieved by the SVR-Firefly, comparatively good results were obtained by both PCA and SVR models. The SVR model suggested the average MAPE value near 1.073 in the training mode under the most unfavorable conditions. The MAPE value equal to 1.23 was also obtained in the test mode. This proves that the value of error rate is tolerable.

Keywords: Weir, Discharge capacity, Support Vector Regression (SVR), Support Vector Regression–Firefly (SVR-Firefly), Response Surface Methodology (RSM), Principal Component Analysis (PCA).