Development of an evaluation method for velocity distribution over cylindrical weirs using doublet concept

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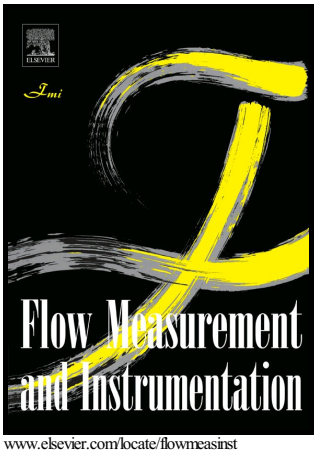

www.elsevier.com/locate/flowmeasinst

PII: S0955-5986(17)30314-X
DOI: https://doi.org/10.1016/j.flowmeasinst.2018.03.008
Reference: JFMI1432

To appear in: *Flow Measurement and Instrumentation*

Received date: 25 July 2017
Revised date: 4 January 2018
Accepted date: 18 March 2018

Cite this article as: Amir Hamzeh Haghiabi, Jahanshir Mohammadzadeh-Habili and Abbas Parsaie, Development of an evaluation method for velocity distribution over cylindrical weirs using doublet concept, *Flow Measurement and Instrumentation,* https://doi.org/10.1016/j.flowmeasinst.2018.03.008

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Abstract

The cylindrical weir is one of the common types of weirs. It can be used for flow measurement, flow diversion and water level control in open channels. Simple design and large discharge coefficient are the main advantages of cylindrical weirs. In present study, flow around cylindrical weirs is simulated by combination of uniform potential flow with two doublets and crest velocity distribution and discharge coefficient of the weir are then obtained. To evaluate the obtained equations, experiments are conducted on three models of cylindrical weirs. A reasonable good agreement is observed between the measured experimental data and the obtained equations.

Keywords: Cylindrical weir; Uniform potential flow; Doublet; Velocity distribution; Discharge coefficient

Notation

C_d	discharge coefficient;
d	crest flow depth;
D	crest diameter of cylindrical weir;
g	acceleration due to gravity;
H	total upstream energy head;
n	number of data;
q	unit discharge;
r	radial coordinate measured from the cylinder center;
R	crest radius;
U	potential flow velocity;
U_1	maximum crest velocity;
u	crest velocity at depth y;
x	streamwise coordinate;
y	distance measured from the weir crest;
Y_1	approach flow depth;
θ	tangential coordinate angle;
δ	boundary layer thickness; and
Ψ	stream function.

Introduction