AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING

STUDY OF TURBULENT LAYER CHARACTERISTICS OF HYDRAULIC JUMP OVER REGULAR ROUGH BEDS IN OPEN CHANNELS

BY
ENG. Abdel-Rahim Abdel-Hamid Ibrahim
(B. Sc. Civil Engineering)

A Thesis
Submitted in Partial Fulfilment of The Requirements
For The Degree of M. Sc. in Civil Engineering

Supervised by

Prof. Dr. M. El-Niazi Hammad

Prof. of Irrigation and Hydraulic Design and
Vice Dean of Faculty of Engineering,
Ain Shams University

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Zagazig University

Dr. Mohamed A. El-Samanoudy

Assoc. Prof., Irrigation and Hydraulic Dept.,
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بسم الله الرحمن الرحيم

بسم الله الرحمن الرحيم

سبحانك

لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم

سورة البقرة آية ٣٢

TO

MY FAMILY

EXAMINERS COMMITTEE

Name, Title & Affiliation		Signature
1.	Prof. Dr. Mohamed El-Niazi Hammad Prof. of Irrigation Design and Hydraulics and Vice Dean of Faculty of Engineering, Ain Shams University	
2.	Prof. Dr. Mohamed Wafaie Abdel-Salam Prof. of Irrigation Design, Faculty of Engineering, Ain Shams University	
3.	Prof. Dr. Mohamed Hamdy El-Kateb Prof. of Irrigation Design, Faculty of Engineering, Cairo University	
4.	Prof. Dr. Talaat Mohamed Owais Prof. of Irrigation Design and Hydraulics, and Dean of Faculty of Engineering, Zagazig University	

STATEMENT

This Thesis is submitted to Ain Shams University for the degree of M. Sc. in Civil Engineering.

The work included in this Thesis was carried out by the author in the Department of Irrigation and Hydraulics, Ain Shams University, from October 1986 to to Oct. 1990.

No part of this Thesis has been submitted for a degree or a qualification at any university or institution.

Date : / /1990

Signature :

Name :Abdel-Rahim A.

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ABSTRACT

The objective of the present study is to investigate the effect of using half cylinders (as strip roughness) with different radii and different intensities upon the characteristics of the free hydraulic jump. In the theoretical study, the dimensional analysis was employed to relate the different factors affecting this studied phenomenan. Moreover, the continuity equation and the impulse-momentum principle, were used to derive expressions relating the relative depth ratio, the relative length of jump and the relative energy loss to the other parameters. Experiments were conducted in a small rectangular flume. Models with different roughness heights (r=0.4, 0.6, & 0.9 cm) and different intensities (10%, 20%, 40%, 80% & 100%) were tested under various flow conditions Another model of roughness height r=1.1 cm and intensities (12.5, 25, 50, & 100%) was also tested. The case of smooth bed was tested and its results were compared with other roughness cases.

Using the experimental data, relationships were plotted to describe the main characteristics of the free hydraulic jump. The experimental data was analyzed and the results of this analysis were presented graphically. Empirical Formulae for the the relative length of the jump, the relative depth and the relative energy loss were obtained using statistical analysis. The analysis of the experimental data revealed that the best roughness intensty of the half cylinders strip roughness is 100%. Also, it was found that the shortest relative jump length on a rough bed will occur when the relative roughness height equals 0.26 for Froude number less than 3.0 and equals 0.55 for Froude number larger than or equals 3.0, and the best roughness ratio (within the experimental range of this study) equals 0.82 for the experimental range of Froude number

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