

UNIVERSITI TEKNOLOGI MARA

**PASSIVE FLOW CONTROL
AROUND CIRCULAR CYLINDER
WITH UNIFORM AND
NON-UNIFORM PERFORATED
SHROUD CYLINDER**

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MSc

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.


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ABSTRACT

The flow pass through a cylinder body is a common practice in engineering application. The effect of flow over the body will give results to structural vibration. Thus, the objective of this research is to reduce or suppress the lift and drag coefficient on the cylinder body using perforated shroud cylinder. Also, the aim is to delay the formation of vortex structure through this passive flow control device. The characteristics of flow pass through a shrouded cylinder is investigated experimentally using uniform and non-uniform hole shrouds. There is still of understanding on the wake characteristics and vortex formation process which effect the efficiency of the passive device. The experiments were performed in two parts, namely wind tunnel and water channel experiment. In wind tunnel experiment, the study was carried out to compare the effect of hole-uniformity of the perforated shroud on lift and drag results. While in water channel experiment, the results of wake behaviour were analysed by comparing the cylinder and each of perforated shrouds model. The shrouds' holes were designed in triangular and square shape. The porosity was set at 25%, 30% and 37% depending on the shroud's configuration after considering limitation for fabrication. The diameter ratio between the shroud and the bare cylinder was set at 2.0. The experiment was performed in a wind tunnel using Reynolds Number of 9.345×10^3 based on the bare cylinder diameter. In the Water channel, the Reynolds numbers used were in the range of 1200-1700. The results showed that although all perforated shrouds cylinder models reduced drag significantly in comparison to that of the bare cylinder, the non-uniform hole shrouds are considered to be more effective than the uniform hole shrouds. Total drag reduction achieved by the non-uniform holes shrouds of 30% porosity(NUT30) was in between 90-95% whereas that of the uniform holes shrouds with 31%(US31) and 30%(UT30) porosity were only 55% and 80%. In the water channel experiment, results obtained showed that all perforated shrouds have delayed the formation of vortices at downstream compared to bare cylinder. The NUT30 (non-uniform holes perforated) showed the best performance in terms of mean fluctuation velocity and highest reduction of transverse velocity fluctuation.

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TABLE OF CONTENTS

	Page
CONFIRMATION BY PANEL OF EXAMINERS	ii
AUTHOR'S DECLARATION	iii
ABSTRACT	iv
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF SYMBOLS	xii
LIST OF ABBREVIATIONS	xiv
CHAPTER ONE INTRODUCTION	1
1.1 Research Background	1
1.2 Problem Statement	3
1.3 Hypothesis	4
1.4 Research Question	4
1.5 Objectives	4
1.6 Significance of Study	4
1.7 Scope and Limitation of Study	5
1.8 Thesis Outline	5
CHAPTER TWO LITERATURE REVIEW	7
2.1 Introduction	7
2.2 Flow over Bluff Body	7
2.3 Flow over Cylinder Body	8
2.4 Types of Passive Device	10
2.4.1 Helical strakes device	10
2.4.2 Fairing devices	13
2.4.3 Slit devices	16
2.4.4 Splitter plate device	19