

UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

NUMERICAL SOLUTION OF BLOOD FLOW IN  
TAPERED OVERLAPPING STENOSED ARTERY  
WITH BODY ACCELERATION

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IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

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## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS</b>	<b>ii</b>
<b>TABLE OF CONTENTS</b>	<b>iii</b>
<b>LIST OF FIGURES</b>	<b>v</b>
<b>ABSTRACT</b>	<b>vi</b>
<b>1 INTRODUCTION</b>	<b>1</b>
1.1 Research Backgroud	1
1.2 Problem Statement	3
1.3 Research Objective	3
1.4 Significant Of Project	4
1.5 Scope Of Project	4
<b>2 LITERATURE REVIEW</b>	<b>5</b>
<b>3 METHODOLOGY</b>	<b>11</b>
3.1 STEP 1 : RADIAL COORDINATE TRANSFORMATION	14
3.2 STEP 2 : DERIVATION OF THE RADIAL VELOCITY COMPONENT	15
3.3 STEP 3 : NUMERICAL PROCEDURE ( APPROXIMATION OF FINITE DIFFERENCE )	16
3.4 STEP 4 : NUMERICAL STABILITY	18
<b>4 IMPLEMENTATION</b>	<b>19</b>
4.1 STEP 1 : RADIAL COORDINATE TRANSFORMATION	19
4.2 STEP 2 : DERIVATION OF THE RADIAL VELOCITY COMPONENT	21

## ABSTRACT

This project is a study about the effect of body acceleration on blood flow in tapered overlapping stenosed artery. The blood is treated as Newtonian fluid and it is assumed to be unsteady, laminar, two dimensional and axisymmetric. Thus, the governing Navier-Stokes equation (continuity equation and momentum equation) are solved where the equation is in the term of cylindrical coordinates and transformed them using radial coordinate transformation. Then, the governing equation with the boundary conditions is discretized by using finite difference method. So, for the numerical results to be obtained, MATLAB programming are developed and are presented graphically. In conclusion, the blood flow characteristics which are the axial and radial velocities of blood can easily determine under the effect of body acceleration. With the presence of body acceleration, the velocity profiles will decrease. The tapered artery with body acceleration is higher than the absence of body acceleration.

# 1 INTRODUCTION

## 1.1 Research Background

The cardiovascular system consists of heart, blood vessels, and the approximately five liters of blood that the blood vessels transport. It plays a very significant role in the regulation, protection and transportation in the human body. The heart is a muscular organ with four chambers. The location of the heart is slightly towards the left of the breastbone and in the middle of the chest between the right and left lungs. The heart acts as a muscular pump because it consists of cardiac muscle. A complete cardiac cycle includes the phase of systole(contraction) and diastole(relaxation). This mechanism is very important to our body for the delivering of oxygen. On the other hand, the circulatory system is a limitless network of vessels for the flow of blood, nutrients and hormones to and from the cells. The system is very important in fight the disease and maintain a body temperature as well as blood pH.

Recently, blood flow has become one of the most concerned studied in biomechanics. This is because various disease could lead to malfunction of cardiovascular system that are related to the blood flow characteristic. Studies showed that about nearly 787,000 people in America died from heart disease, stroke and other cardiovascular disease in 2011 (Virani SS, 2014). Most of these arterial disease begin with minor arterial stenosis. For example, the arteriosclerosis means the stiffening of arteries. Healthy arteries have smooth inner lining and the deposition would interrupt the smoothness of blood flow.

One of the common condition which would cause irregularity to cardiovascular mechanisms is arterial stenosis. Arterial plaque are caused by substances deposition which made up deposits of fatty substances, calcium, fibrin or other cellular waste products which will develop in inner lining of arteries and cause segmental narrowing. This will lead to abnormal blood flow and may form blood clots. Therefore, it cannot carry out its function effectively. The stenosis could increase the blood pressure and reduce their elasticity. Due to the lacking of