

UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

MODELLING OF BLOOD FLOW IN HUMAN BY
USING WINDKESSEL MODEL

NURUL NADIAH BINTI MOHAMMAD
2014665464 D1CS2496D
AMIRA FAIRUZ BINTI ADNAN
2014805626 D1CS2496D

Report submitted in partial fulfillment of the requirement
for the degree of
Bachelor of Science (Hons.) Mathematics
Center of Mathematics Studies
Faculty of Computer and Mathematical Sciences

JULY 2017

ACKNOWLEDGEMENTS

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

Firstly, we are grateful to Allah S.W.T for giving us the strength to complete this project successfully.

We would first like to thank our supervisor, Madam Wan Nurul Husna Binti Wan Nordin for our final year project, The Modelling of Blood Flow in Human by using Windkessel Model. The door to Madam Wan Nurul Husna office was always open whenever we ran into a trouble spot or had a question about the project. She consistently allowed this paper to be our own work, but steered us in the right direction whenever she thought we needed it.

We would also like to thank the entire panel during our presentation for the proposal of our final year project. Without their advice and input, the project could not have been successfully conducted.

Finally, we must express our very profound gratitude to our parents and to our beloved course mate for providing us with unfailing support and continuous encouragement throughout years of study and through the process of finishing this project. This accomplishment would not have been possible without them. Thank you.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	ii
TABLE OF CONTENTS	iii
LIST OF FIGURES	v
LIST OF TABLES	vi
ABSTRACT	vii
1 INTRODUCTION	1
1.1 Research Background	1
1.2 Problem Statement	2
1.3 Research Objective	3
1.4 Significant Of Project	3
1.5 Scope Of Project	3
2 LITERATURE REVIEW	4
3 METHODOLOGY	6
3.1 Derivation of 2-element equation in Windkessel model	7
3.2 Derivation of 3-element equation in Windkessel model	8
3.3 Derivation of 4-element equation in Windkessel model	9
4 IMPLEMENTATION	11
4.1 Derivation of the equation	11
5 RESULTS AND DISCUSSION	17
6 CONCLUSIONS AND RECOMMENDATIONS	21

ABSTRACT

In order to provide a platform for the maximum healthy living style, this project is done to study the blood flow into the aorta. As the main component, aorta continuously supplies the blood containing oxygen, and nutrients to all parts of the body in general. Windkessel model is used as the model to this project as Windkessel model is frequently used to represent the relation between blood flow to the aorta and blood pressure. It describes the flow of blood through the arteries as the flow of fluid through pipes. So in this project, the electrical analog is used to represent the blood flow to the aorta. This project will briefly explained about three element in Windkessel model which consist of 2-element, 3-element, and 4-element. The results plotted on graph by using MATLAB is to show the blood pressure with various initial condition and the comparison graph between 2-element and 4-element of Windkessel model.

1 INTRODUCTION

1.1 Research Background

The Circulatory system which also known as cardiovascular system or the vascular system is one of the system in the human body. This system can be thought as a transport system in human body. According to Quarteroni (2006) the main function of the circulatory system is to supplying all of the human organ with blood. This circulatory system allows blood to transport and circulate nutrients, oxygen, carbon dioxide, hormones, and blood cells to and from the cells in the body and stabilize temperature and Ph and also help in fighting diseases (Korakianitis & Shi, 2006).

There are three important components that involve in this system which is the heart,blood and also blood vessel. The circulatory system consist of two circulation which is pulmonary circulation and systemic circulation. Pulmonary circulation is one of the part from cardiovascular system that only involve heart and lungs only. This circulation is where it transport deoxygenated blood from the heart to the lung and transport back the oxygenated blood to the heart. Meanwhile,the systemic circulation also known as bronchial circulation is a circulation of the blood to all parts of the body exclude the lungs. Systemic circulation is the circulation where it carried away the oxygenated blood from the heart through the aorta to the rest of the body,and returns the deoxygenated blood back to the heart.

As can be expected from an organ that responsible for transporting the blood throughout the entire body, the root of heart disease is when the passage of it is blocked. Heart disease or cardiovascular disease encompasses a range of condition which including blood vessels disease such as coronary artery disease, problem with heart rhythm and congenital heart defects. The extreme cases of heart disease result in total heart failure where the only long term cure is the heart transplant.

According to the Fatema et al. (2015) in the context worldwide,more than 16 million peo-