

**SIGNAL ANALYSIS**  
**(INSTANTANEOUS ENERGY AND FREQUENCY)**  
**OF HEART SOUNDS AND HEART MURMURS**

This Project Report is presented in partial of fulfilment for the award of Bachelor in  
Electrical Engineering (Honours)

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## ABSTRACT

The objective of this project is to analyse the characteristic of heart sound and heart murmurs using signal processing techniques for common heart diseases. There are several signal analysis techniques, but the techniques will be applied to heart sound data in this project is Instantaneous Energy (IE) and Instantaneous Frequency (IF) by using Central Finite Difference Frequency Estimation (CFDFE). The present technique among the physician to examine the condition of patient heart sound is using an instrument called stethoscope. The effectiveness of this technique depends largely on skills, experiences and the hearing ability of a physician. From the study of the characteristic of human heart sound and ability of human hearing, it is seen that only highly trained ears may differentiate between normal and pathological heart sound. The specific purpose of this research is to identify and develop the suitable and accurate technique to detect, distinguish and classify between normal heart sound and murmurs. This analysis is based on a set of 101 simulated data that represents several classes of heart sound. After the parameters of the heart sounds and murmurs are extracted, the rule-based method is employed to classify the heart sounds and murmurs based on the 7 predetermined heart classes. The graph from the result will be analysed and classified into normal heart sound or pathological murmurs. All analysis is done using MATLAB<sup>®</sup> mathematical software. The Central Finite Difference Frequency Estimation (CFDFE) techniques is the best method to differentiate between the normal and pathological heart sound. So by using this new technique, it hopes that the normal and pathological heart sound can be easily differentiated without risk to the patient.

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## INTRODUCTION

### 1.1 Background

In 1819, the first use of a wooden ear trumpet (stethoscope) for the purpose of auscultation was reported. The main reason was to avoid a direct listening with the ear to the heartbeat, which was regarded as being “non-decent and inconvenient”. Very soon, however the outstanding acoustical feature of stethoscope were recognized [8].

Auscultation and signal analysis technique is an important diagnostic tool, this project will make use of this method to capture the signals and perform parameter extraction and classification of heart sounds and heart murmurs.

### 1.2 Objective

The objective of this research project is to identify and understand several signal processing techniques that suitable and accurate to detect and classify between normal and pathological heart sound. By applying knowledge engineering in signal processing technique, the classification between normal and pathological heart sound can be distinguished easily and accurately, which will be helpful for doctors to enhance their clinical work. Two signal analysis techniques will be applied to heart sound data to detect the potential heart problem. The techniques also will overcome the subjectivity of using heart auscultation and the permanent record of the analysis will be provided for future references.

The main objective of this project is to identify and develop the suitable and accurate technique to detect and classify between normal heart sound and murmurs. The signal processing techniques that are used in these project are Instantaneous Energy and Instantaneous Frequency Estimation (Central Finite Difference Frequency