CHAPTER 1
INTRODUCTION

1.1 ANEURYSMS

Aneurysm is a localized, blood-filled dilation (balloon-like bulge) of a blood vessel caused by disease or weakening of the vessel wall. Aneurysms most occur in arteries at the base of the brain (the circle of Willis) and in the aorta (the main artery coming out of the heart, a so-called aortic aneurysm). A sign of an arterial aneurysm is a pulsating swelling that produces a blowing murmur on auscultation (the act of listening for sounds in the body) with a stethoscope.

There are four main locations where aneurysms always happen that are Cerebral Aneurysms (CA), Aorta Aneurysms, Abdominal Aneurysms and Thoracic Aortic Aneurysms. As the size of an aneurysm increases, there is an increased risk of rupture, which can result in severe hemorrhage or other complications including sudden death. Severe bleeding can occur if the aneurysms break or rupture. Not all aneurysms are life-threatening. But if the bulging stretches the artery too far, this vessel may burst, causing a person to bleed to death. An aneurysm that bleeds into the brain can lead to stroke or death. Aneurysms usually appear in either fusiform or saccular.

A fusiform aneurysms is spindle shaped without a neck. While, the second type of aneurysms is saccular. The saccular aneurysms are the most frequent cerebral aneurysms showing a berrylike outpouchings of the vessel wall; they often develop at the curved side of the vessels or at the apex of bifurcations.
1.2 PROBLEM STATEMENT

Nowadays, the case of rupture of CAs is often occurs without any preceding symptoms. The rupture occurs when the stress acting on the aorta wall exceeds the strength of the aorta wall itself. It was necessary to establish reliable criteria of the rupture risk assessment procedures in CAs for these lesions, and criteria based on the mechanical field. Besides that, the prediction of rupture happens is not available yet. The stress distribution caused by pressure in the cerebral is one element factor that influenced the rupture of aneurysm. So it was necessary to study the behavior of these elements to better understanding of aneurysm.

1.3 PROJECT OBJECTIVES

The first objective of this project is to study the the wall stresses in each virtual of CA and investigate the finite element analysis with different diameter of CA.

The second objective is to analyze the effect of geometry that influence the magnitude and distribution of the peak wall stress in the aneurysm. The cerebral aneurysms is locate at the brain and focus on the saccular shape of aneurysms. In this objective, the project will focused on the diameter of aneurysms to determine how it influence the rupture of aneurysm.

1.4 PROJECT SCOPE

In order to achieve those objectives, some limitations were decided to range the whole study. Therefore, the main concerned is to analyze cerebral aneurysms located in COW (Circle of Willis) with certain software. Three-dimensional (3D) models of CA with different diameter of aneurysm are created before the finite element analysis take place.

All the solutions of the problem presented in this study will be based on numerical approach only. The results of these analyses through numerical solutions are expected to explain the wall shear distribution and peak wall stress in the aneurysm.