CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Piston rod failure continues to be the major problem concern for the automotive industry. In this analysis, piston rod phenomenon is analyzed using modal analysis method. The modal analysis excitation technique has been carried out to obtain modal parameter of piston rod structure namely the natural frequencies of the piston rod.

Figure 1.1: Piston rod failure

Figure 1.1 shows piston rod assembled together with piston. The piston is facing failure and no longer available to be use. Failure is occurred due to frequency comes from vibration force applied to piston rod is higher than the natural frequency of that piston rod.
Simulation technique can be used to verify the natural frequency obtained from finite element modeling using ALGOR software and also Solidwork to validate the computational modeling since the measurements were taken on the true structure of piston rod.

Modal analysis is one of the best methods used to understand the piston rod phenomenon. Experimental modal analysis excitation technique can determine the natural frequencies of the connecting rod failure that strongly related to resonance. This investigation is quite important since piston rod phenomenon often involves various mode shapes associated to natural frequency.

1.2 PROBLEM STATEMENT

Despite the convenience provided by simulation software, however there are still errors that arise due to material properties, technical issues and less proper procedures while performing the analysis. For example, result of natural frequency from finite element analysis is not precisely generated. Each mode shape having large range of frequency, plenty of peaks in a graph, graphical setup, error in calibration, efficiency of material testing machine are all influence the errors in determining dynamic behavior of piston rod. Values of natural frequency suggested at the end of project may inaccurate.

1.3 PROJECT OBJECTIVE

The objective of this project is to determine the dynamic behavior of piston rod in a small engine and thus determining the natural frequency and mode shapes by performing experimental and simulation approach.

1.4 PROJECT SCOPE

The related scope of this project is selection of piston rod that needs to be used in simulation and experiment methods. Next scope is determination of
mechanical properties of the material. As example, it includes density, young modulus and other parameters.

Then, modeling process in computer aided design (CAD) software based on specific design. After that, scope of project proceeds with finite element analysis in Algor software to identify mode shape and neutral frequency for first five nodes.

Next is carry out modal analysis using available equipment. Last but not least, comparison between simulation and experimental result.