

Abstract

Masters of Engineering Degree (Mechanical)

Project Title:

Knock Detection System

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Engine knock is a detrimental phenomenon that occurs in the combustion chamber of the engine that can cause irreversible damage. The goal of this project is to develop and implement a system to reliably detect the early stages of knock on the FSAE engine dyno in order to determine ideal spark timing values to maximize performance without damaging the engine. This requires a basic understanding of how the engine dyno works, writing LabVIEW code to record and analyze data from two different sensors, and collecting data from engine testing and performing analysis in conjunction with the core FSAE team. The two sensors used are an in-cylinder spark plug pressure sensor and Honda CBR600RR OEM knock sensor. The spark plug pressure sensor outputs comprehensive information on the pressure inside the cylinder (including knock), however, the OEM knock sensor is more practical for use on the race car than the spark plug pressure sensor. Unfortunately, the Honda OEM knock sensor is proprietary equipment so not much is known about it. This project attempts to calibrate the two sensors so that only the OEM knock sensor is used for knock detection. Testing involved advancing the spark timing on the engine dyno in order to incur knock and then recording the resulting data with the two sensors. A Fast Fourier Transform is performed on the OEM knock sensor time domain data to generate frequency domain data for determining knock frequency. Unfortunately, testing was limited because of problems with the engine dyno. A complete and working knock detection system was developed with the spark plug pressure sensor, however, the OEM knock sensor still needs to be properly calibrated. This project paves the way for the future in developing a closed-loop knock correction system using only the OEM knock sensor and eventually implementing this knock detection and correction system on the race car. This report also gives an overview of engine knock and the previous work that students have done regarding this project.