



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

THE IMPACT OF ENGINE PERFORMANCE ON NATURALLY ASPIRATED: CASE STUDY FUEL PARAMETER

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive) with Honours.

by

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ABSTRAK

Setiap produk yang melibatkan prestasi enjin akan dioptimumkan penggunaannya mengikut keupayaan, ketahanan dan keperluan di atas jalan raya untuk menarik pengguna. Ramai pengguna menumpukan kepada pengubahsuaian kos yang tinggi untuk meningkatkan keupayaan enjin serta sesetengah daripada mereka juga berfikir tentang penjimatan bahan api. Setiap operasi sudah ditetapkan program dan ianya dikawal oleh Electronic Control Unit (ECU). ECU asal perlu ditukar terlebih dahulu supaya program asal tidak terganggu dan boleh digunakan andai kata ujian yang dijalankan menghadapi masalah. Oleh itu, projek ini akan menumpukan kepada peningkatan berlaku atau tidak apabila ECU berteknologi tinggi dipasang pada enjin Campro 1.6 L dan parameter yang diutamakan pada Air Fuel Ratio (AFR). Walaubagaimanapun, pemetaan pencucuhan akan dilakukan untuk mengikut kepada prosedur yang ditetapkan. Untuk menyelesaikan kajian ini, dynamometer enjin akan digunakan dan setiap bacaan yang diambil akan bermula dari 2000 RPM sehingga kapasiti maksimum enjin 6000 RPM, untuk membuat analisa dan perbincangan hasil yang diperolehi akan diplot.

ABSTRACT

Each product involving engine performance will be optimized according to the capabilities, durability and requirements of the road to attract consumers. Many users focus on high cost modifications to change the engine's increased power, and some of them also think about fuel savings. Every operation already has a program that has been set up and controlled by the Electronic Control Unit (ECU). The original ECU needs to be changed so that the base map is not disrupted and can be used if the test run is face some problem to change the system or data that was designated. Therefore, project focuses on determining wheter an increase occurs when the stand alone ECU is connected to the Campro 1.6 L engine and the preferred parameter is fuel. However, ignition mapping is also carried out in such a way that each setting changes according to the set procedure. To complete this study, the engine dynamometer will be used and during test running every reading will start from 2000 RPM to maximum engine capacity of 6000 RPM, to make analysis and discussion of the result obtained will be plotted.

DEDICATION

This dedication to my parents Mr Mohamad Rozali bin Che Ahmad and my mother Mrs Azirah binti Ismail also to my siblings and my late supervisor Mr Ahmad Zainal Taufik bin Zainal Ariffin that always support me.

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LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inersia
l	-	Length
m	-	Mass
N	-	Rotaional velocity
P	-	Pressure
Q	-	Volumetric flow-rate
r	-	Radius
T	-	Torque
Re	-	Reynold number
V	-	Velocity
w	-	Angular velocity
x	-	Displacement
z	-	Height
q	-	Angle

LIST OF ABBREVIATIONS

ICE	Internal Combustion Engine
ECU	Engine Control Unit
EMS	Engine Management System
ECM	Engine Control Module
OEM	Original Equipment Manufacturer
EFI	Electronic Fuel Injection
CAMPRO	Cam Profiling
VVT	Variable Valve Timing
DOHC	Dual Over-Head Camshaft
N/A	Naturally Aspirated
BHP	Brake Horse Power
RPM	Rev per Minute
MAF	Mass Air Flow
AFR	Air-Fuel Ratio
TPS	Throttle Position Sensor
MAP	Manifold Absolute Pressure

CHAPTER 1

INTRODUCTION

1.1 Introduction

Chapter one consists of the background of the project for this dissertation. The information of the naturally aspirated work and device used to blend air and fuel that is carburetor and fuel injection, in this chapter also has a few information about Electronic Control Unit (ECU). Secondly, this section also consists of another four item which consist of the investigation and the analysis, the objective of this dissertation, problem statement of the issues and scope of the work for this project.

1.2 Background

A normally aspirated engine is an inside internal combustion engine in which oxygen admission relies upon totally on atmospheric pressure and does not rely upon forced induction through a turbocharger or supercharger. In a naturally aspirated engine, air for combustion like specific forms of Otto cycle in petrol engines or an air and fuel combination is drawn into the engine's cylinders by way of atmospheric pressure performing towards a partial vacuum that occurs because the piston travels downwards closer to bottom dead center during the intake stroke. Because of inborn point of confinement inside the engine's inlet tract, which consolidates the intake manifold, a little pressure drop occurs as air is attracted, bringing about a volumetric productivity of under

100% and a not as much as whole air rate in the chamber. The density of the air rate, and therefore the engine's maximum theoretical power output, similarly to being prompted by way of induction system restrict is also tormented by engine speed and atmospheric pressure the latter of which decreases because the working altitude increase.

A carburetor is a tool that blends fuel and air, all things considered a supplies the blend to the admission complex of an inward burning motor. The carburetor has a few abilities it combines fuel and air making an especially ignitable blend, carburetor additionally manages the ratio of air and fuel and it controls the engine's pace. Early carburetors finished this by utilizing practically allowing air to disregard the surface of the fuel, however most later circulated a metered amount of fuel into the air flow. Most of old vehicle use a carburetor system as a mechanism to mixing fuels and air to make the mixture into the combustion chamber. On the off chance that there is lacking fuel combined with the air, the engine will run lean that may make harm the engine. Within the event that there's an additional of fuel mixed with the air, the engine will keep running in rich mix that reason in to run ineffectively or in event causing high fuel utilization.

Previous study also conclude that ECU based system works on a very chemically accurate mixture as compared to carburetor system and due to this brake specific fuel consumption is low in ECU based system causing increase in brake thermal efficiency (S. J Adsul P. A Mane S. S. Mulay, 2013). Bosch, R (1991, cited Calin ICLODEAN and Nicolae BURNETET 2013) explained that in the operation of the vehicle for command and control of parameters, complex system of electronic modules in the ECU in used. ECU consist of operating principle for input data, data processing, delivery date, or IPO (Input – Process – Output).

To keep up reasonable drivability and fuel economic system, engine management system was developed from carburetor to fuel injection system. Just the revelation on fuel injection system wind up not adequate. In any case, the disclosure of the electronic injection system, is additionally basic as well. The electronic control system incorporates differing engine sensors, electronic control unit (ECU), fuel injector gatherings and related wiring. electronic control units (ECU) goes about as the brain to control the whole EMS. The ECU decides precisely how an incredible arrangement fuel wants to be conveyed through the injector by methods for checking the motor sensors. the ECU turns the injectors on for an exact measure of time, known as injection pulse width or injection period to supply the correct air and fuel proportion to the engine.

An engine electronic control unit (ECU) additionally known as an engine control module (ECM), functionality of electronic control unit is a fragment that controls an actuators way of movement on an internal combustion engine to make certain most useful engine performance. It does this by means of techniques for perusing esteems from countless sensors inside the engine bay, disentangling the data utilizing multidimensional execution maps, and changing the engine actuators. Before ECUs, idle speed, ignition timing and air-fuel mixture had been mechanically set and ceaselessly managed by using mechanical and pneumatic approach. On the off chance that the ECU has managed over the fuel strains, by then it is known as an Electronic Engine organization structure (EEMS). The fuel injection system has the main role to govern the engine's fuel deliver. The total mechanism of the EEMS is controlled through a heap of sensors and actuators.

Most present engines utilize a couple of sort of fuel injection to deliver fuel to the chambers. The ECU decides the measure of fuel to inject construct absolutely with

respect to some of sensor readings. Oxygen sensors tell the ECU whether the motor is running rich (an excess of fuel or too little oxygen) or walking lean (a lot of oxygen or too little fuel) in contrast with idealize conditions (known as stoichiometric). The throttle position sensors light up the ECU how far the throttle position is opened whilst you press the quickening agent. The mass air drift sensor measures the amount of air spilling into the engine by means of the throttle plate. The engine coolant temperature sensor measures whether the engine is warmed up or cool, if the engine is up 'til now cool, extra fuel may be injected. Air– fuel blend control of carburetors with PC frameworks is planned with a comparable guideline, however a blend control solenoid or stepper engine is consolidated inside the accept circumstances for what they are bowl of the carburetor.

1.3 Problem Statement

An individual will use the first car of a sedan type that has a high horsepower and torque and the vehicle is a sedan type. As time passes he has a bigger family and of course he'll use a larger vehicle type MPV. Horsepower and torque owned with the aid of these two styles of vehicles are very different and reason the individual to want the horsepower, torque and fuel economy of his sedan vehicle to the used MPV vehicle.

Therefore, there are some parameters that can be modified to specify the settings required by the user or the driver against the ECU used. Before that, some settings to study effects of ECU behavior on the engine is needed, such as setting of the ECU in an effort to have an effect on the engine performance, different parameter setting will produce different performance result and driver priorities of need will set to ECU when tuning.

To solve this problem some analysis from previous studies were conducted. In addition, several tests are also conducted to ensure that the data is capable of showing changes that may support the ongoing research. Among the tools used to make the study is the engine dynamometer and also the Haltech programmable ECU.

1.4 Objective

The main objective of this research is by using the software of engine tuning for the automation process of engine tuning that interacts with ECU and the controller of dynamometer that will affect the engine performance. the aim can be achieving by:

- 1) To analysis the torque and horsepower of the engine in view of ECU's fuel setting by using engine dynamometer.
- 2) To compare the engine performance according to the data obtained by the engine dynamometer between stockholder ECU and reprogrammable ECU setting.

1.5 Scope

This research will be focusing on the performance of the Campro 1.6 L DOHC engine by manipulating fuel timing parameters in the ECU. The engine will be test on the engine dynamometer to obtain the performance result between stocked ECU setting and MoTeC programmable ECU setting. The horsepower, torque and Air Fuel Ratio (AFR) result for those two different ECU setting will be compared.