

University of Macau

Abstract

**Computer-Aided Calibration for Compensation Maps
of Engine Management Systems**

by

Chang Fong Long

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Thesis Supervisor: Professor Wong Pak Kin

Department of Electromechanical Engineering, Faculty of Science and Technology

Nowadays, automotive engines are controlled by many compensation maps in engine management systems (EMS). Modern engine compensation control adjusts the fuel injection duration and ignition advance electronically, such that the engine can sustain engine torque, fast starting time, long service life, fast response and low emissions. These are subject to variations in engine conditions (such as temperature and battery voltage) and environmental parameters (such as air temperature and atmospheric pressure). In traditional engine compensation map calibrations, the parameters are normally set empirically through many experiments. Trial and error usually dominates the calibration process. Therefore, much in human resources, time and consumable items are consumed in calibration. Moreover, sometimes optimal compensation maps may not be found because there is currently, no exact mathematical engine model

available. In this project, an emerging machine learning technique, Least Squares Support Vector Machines (LS-SVM), is proposed to build a engine compensation control model based on experimental data. Genetics algorithm (GA) and chaos optimization are then applied to the models built to produce an optimal calibration map. In order to find the best optimization method for this problem domain, the fitness values using GA and chaos optimization are compared. Practically, modern automotive engines involve many compensation control maps, so this project studies a few typical ones in order to demonstrate the methodology. Experimental results show that the proposed methodology is feasible.