

# Engine and Auxiliary Systems

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Edited by  
Prof. Dr. A.K.M. Mohiuddin



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# **Engine and Auxiliary Systems**

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### **Introduction**

In the internal combustion engine, valve timing plays a crucial role in order to improve engine performance. Since many years, a lot of giant automobile manufacturers in the world have developed powerful VVT (Variable Valve Timing) engine which has advantages on fuel economy, engine power, torque, low emission etc. In fact, valve train system is one of the critical key systems to design better engine performances.

Genetic algorithm is one of the recently developed high robustness and multi-objective optimization purpose evolutionary types of algorithm that uses the analogy of natural selection and reproduction as optimization concept in order to seek for the absolute optimal solution.

Designing of an engine usually will lead to the field of design optimization in order to provide optimal tuning to the engine. Classical optimization is easily dealt with a single objective problem. Unfortunately, in real life, especially solving engineering problems, it will always involve highly non-linear and complex model. Therefore, multi-objective optimization is a good practice in solving this real engineering problem. In this project, the multi-objective optimization is using Multi-Objective Genetic Algorithm (MOGA) which is famous with its robustness optimization strategy.

Majority of the research works in this project were in CAE software environment and 1D engine simulation. The chapter conducts robust design optimization of CAMPRO 1.6L (S4PH) engine valve timing at various engine speeds using multi-objective genetic algorithm (MOGA) for the future variable valve timing (VVT) system research and development. This chapter involves engine modeling in 1D software simulation environment, GT-Power. GT-Power is one of the CAE tool available in GT-SUITE developed by Gamma Technologies Inc. The tools available in the GT-SUITE contain GT-Power, GT-Drive, GT-Vtrain, GT-Cool, GT-Fuel and GT-Crank [1]. Each of the tools has powerful application and analysis ability on different part of automobile. Then, the GT-Power model is run simultaneously with modeFrontier to perform multi-objective optimization.