Parametric Study of CNG-DI Engine Operational Parameters by Using Analytical Vehicle Model

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Abstract:
. A parametric study of engine's influential parameters on compressed natural gas direct injection (CNG-DI) engine's torque was performed by using a dynamic, analytical model of the CNG-DI vehicle. The objective of the study is to analyze the effect of the selected six parameters on the engine's total brake torque. The simulations were carried out to mimic the speed-sweep test procedure of the vehicle on a chassis dynamometer. Based on the actual test setup, a ramp input is provided on the power pedal and the vehicle is allowed to accelerate under the influence of dynamometer inertia load only. Based on the results, the most influential parameter on the maximum engine torque is the injection pressure. The maximum predicted engine mean brake torque at 60 bar injection pressure is about 120 Nm. The second influential parameter is the injection duration, where the maximum predicted engine brake torque is about 100 Nm. Both parameters are related to the controlling amount of the fuel-injected, which affected the amount of energy released into the cylinder. The third influential parameter is the ignition timing, where the maximum pressure predicted is closed to 70 bar. It can be concluded that the magnitude of brake torque is sensitive to the amount of fuel supplied for combustion. This comprehensive model is suitable for parametric analysis regardless of the expensive computing time.

Keywords: Dynamic Modelling; Transient Simulation; Gas Direct-Injection

Acknowledgments

We would like to express our sincere gratitude to The Ministry of Education and Uni-versiti Malaysia Pahang who has funded the study under research grant numbered FRGS/1/2017/TK03/UMP/03/2 and RDU1703145, members of Automotive Labora-tory, and Innovative Manufacturing, Mechatronics and Sports laboratory which facilitate the study from the beginning.