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Development of Intake System for Improvement of Performance of Compressed Natural Gas Spark Ignition Engine

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Abstract : The improvement of flow strategy was implemented in the intake system of the engine to produce better Compressed Natural Gas engine performance. Three components were studied, designed, simulated, developed,tested and validated in this research. The components are: the mixer, swirl device and fuel cooler device. The three components were installed to produce pressurised turbulent flow with higher fuel volume in the intake system, which is ideal condition for Compressed Natural Gas (CNG) fuelled engine. A combination of experimental work with simulation technique were carried out. The work included design and fabrication of the engine test rig; the CNG fuel cooling system; fitting of instrumentation and measurement system for the performance testing of both gasoline and CNG modes. The simulation work was utilised to design appropriate mixer and swirl device. The flow test rig, known as the steady state flow rig (SSFR) was constructed to validate the simulation results. Then the investigation of the effect of these components on the CNG engine performance was carried out. A venturi-inlet holes mixer with three variables: number of inlet hole (8, 12, and 16); the inlet angles (300, 400, 500, and 600) and the outlet angles (200, 300, 400, and 500) were studied. The swirl-device with number of revolution and the plane angle variables were also studied. The CNG fuel cooling system with the ability to control water flow rate and the coolant temperature was installed. In this study it was found that the mixer and swirl-device improved the swirl ratio and pressure condition inside the intake manifold. The installation of the mixer, swirl device and CNG fuel cooling system had successfully increased 5.5%, 5%, and 3% of CNG engine performance respectively compared to that of existing operating condition. The overall results proved that there is a high potential of this mixer and swirl device method in increasing the CNG engine performance. The overall improvement on engine performance of power and torque was about 11% and 13% compared to the original mixer.

Keywords : intake system, Compressed Natural Gas, volumetric efficiency, engine performance
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