Analysis of Modifications on a Spark Ignition Engine for Operation with Natural Gas

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ABSTRACT

Transportation is one of the key contributors to petroleum usage and emissions to the atmosphere. According to researchers, there are many ways to use transport by using renewable energy sources. Of these solutions, the immediate solution which requires less modification to current engine technology is by using gaseous fuels. Natural gas is the fuel of choice for minor modification to current engines. As it can be derived from anaerobic digestion process, the potential as a renewable energy source is tremendous, especially for an agricultural country such a Malaysia. The aim in the future will be operating an engine with natural gas only with pipelines straight to houses for easy filling. The fuel is light and can be easily carried in vehicles when in compressed form. As such, Compressed Natural Gas (CNG) is currently used in bi-fuel engines, but is mostly not optimized in term of their performance. The focus of the paper is to optimize a model of natural gas engine by one dimensional flow modeling for operation with natural gas. The model is analyzed for performance and emission characteristics produced by a gasoline engine and later compared with natural gas. The average performance drop is about 15% from its gasoline counterpart. The 4% benchmark indicates that the modification to ignition timing and compression ratio does improve engine performance using natural gas as fuel.

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