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International Review of Mechanical Engineering (IREME)

Performance Optimization of a Spark Ignition Engine Fueled with Gasoline-Bioethanol (E85) Using RSM and Non-Linear Programming Approach

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Abstract

The aims of this work are to obtain the characteristics and the performance optimization of the spark-ignition engine and single-cylinder by using the gasoline-bioethanol fuel blend in composition 15%-85% (E85). The Response Surface Methodology (RSM) and the Non-Linear Programming are applied in this work in order to find the area and the optimization point of the engine performances. The engine operates on different engine speeds in the range 2000–8000 RPM (increment 1000 RPM), ignition timing in interval 12–28 BTDC (increment 4 BTDC) and compression ratio in range 12–13 (increment 0.5). All the performance engine parameters of E85 fuel are better than gasoline engine performance except for specific fuel consumption and thermal efficiency that is worse than E0. Those results will be obtained when the engine parameters work on the compression ratio, 16-20 BTDC (before top dead center) of ignition timing, and higher than 4000 RPM (revolution per minute). Meanwhile, the optimization of the engine performances has been done by using Box Behnken design of response surface methodology. The methodology shows that the optimal values of the engine performance are obtained for 13:1 of compression ratio (CR), 24 BTDC of

Ignition Timing (IT) and 7240 RPM of engine speed. The result of this study has revealed that at optimal parameters the values of the brake power, brake torque, thermal efficiency, mean effective pressure, specific fuel consumption, CO and HC emissions have been 12.68 HP, 12.90 Nm, 32.4%, 1083.8 kPa, 0.004224 kg/hp h, 2.6% and 89.9 ppm respectively.

Keywords

Ethanol-Gasoline Blend; Response Surface Methodology; Spark Ignition; Performance Optimization

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