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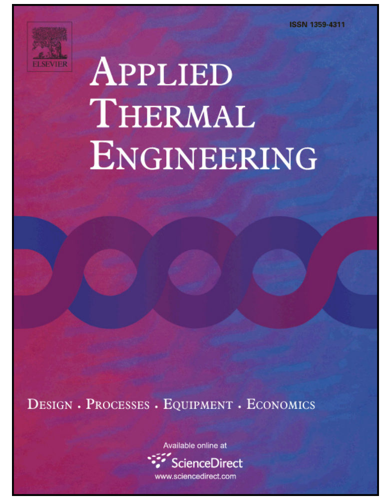

Regression analysis and optimization of diesel engine performance for change in fuel injection pressure and compression ratio

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1. Introduction

Diesel engines are extensively used in transportation and power generation sectors because of their better fuel economy compared to petrol engines. Due to their widespread use, these engines are also huge sources of harmful exhaust emissions that affect human health and environmental air quality. Also, diesel fuel is on the verge of exhaustion in the near future due to its limited resources. In view of the above mentioned problems, there is a need to improve the performance of diesel engines to extend their availability in the future. Also, bearing in mind the increasingly severe emission norms, the efforts are being made all over the world to make the exhaust emissions from these engines as low as possible.

The improvement in performance and emission characteristics of diesel engines urges the need for modification in existing engine designs. The modification to be incorporated in these engines, should be feasible in both economical and practical aspects. This requires extensive knowledge of the various parameters and their relationship with engine output characteristics.

The fuel injection pressure (FIP) is a parameter that has been studied by various researchers for its effect on diesel engine performance with different fuels. Puhan et al. [1] found increase in brake thermal efficiency with Linseed Oil Methyl Ester (LOME) for FIP 240 bar compared to diesel at 200 bar. Except Nitric oxides (NO) emissions, the hydrocarbons (HC), carbon monoxide (CO) and smoke emissions were lower for LOME for all FIP compared to diesel at 200 bar. Agarwal et al. [2] observed superior engine performance and emission characteristics at lower FIP (500 bar) and suggested further improvement by advancing start of injection timing. The increase in injection pressure resulted in better brake specific fuel consumption (BSFC) and brake thermal efficiency (BTE) and boosted maximum cylinder gas pressure due to increase in premixed combustion phase [3]. Jindal et al. [4] found 10% improvement in BSFC and 8.9% improvement in BTE at 250 bar FIP and CR 18 over standard settings. Higher FIP resulted in better combustion due to finer droplets providing more surface area and better mixing with air. It was seen that the HC, oxides of nitrogen