BENEFITS AND CHALLENGES OF VARIABLE COMPRESSION RATIO AT DIESEL ENGINES

by

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The compression ratio strongly affects the working process and provides an exceptional degree of control over engine performance. In conventional internal combustion engines, the compression ratio is fixed and their performance is therefore a compromise between conflicting requirements. One fundamental problem is that drive units in the vehicles must successfully operate at variable speeds and loads and in different ambient conditions. If a diesel engine has a fixed compression ratio, a minimal value must be chosen that can achieve a reliable self-ignition when starting the engine in cold start conditions. In diesel engines, variable compression ratio provides control of peak cylinder pressure, improves cold start ability and low load operation, enabling the multi-fuel capability, increase of fuel economy and reduction of emissions. This paper contains both theoretical and experimental investigation of the impact that automatic variable compression ratios has on working process parameters in experimental diesel engine. Alternative methods of implementing variable compression ratio are illustrated and critically examined.

Key words: *diesel engine, efficiency, emission, variable compression ratio, working process*

Introduction

It is well known that diesel engines are one of the best candidates to face the future CO_2 limitations thanks to their high thermal efficiency. In modern diesel engines, the relation between NO_x and particle emissions has to be deeply improved, maintaining low CO_2 emission [1, 2]. On the other hand, downsizing tendencies lead to increased specific power and torque output [3]. Objectives for power (55-65 kW/L at 4000 rpm) and for torque (170-200 Nm/L at 1500-2000 rpm) are possible today [3].

As a solution, adequate after-treatments, NO_x and particle traps have been developed. However, there are some concerns about fuel economy, robustness, fuel sulphur sensitivity and costs due to their complex management [4, 5].

Another way may be the reduction of these pollutant emissions directly in the engine, concurrent with after-treatment, using homogeneous charge compression ignition (HCCI) com-

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