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The Effects of IVC Modulation on Modern Diesel Engines Equipped with Variable Valve Actuation at High Load and Speed

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ABSTRACT

Modern diesel compression engines are known for their increased durability, fuel economy and torque when compared with their spark ignition gasoline counterparts. These are some of the reasons why diesel engines are preferred in heavy duty applications such as trains and semi-trucks. During the Heavy Duty Federal Test Procedure transient drive cycle, or HDFTP, nearly 85% of the total fuel burned is at speeds greater than 2000 revolutions per minute (RPM) for the studied engine. Therefore, it is desirable to increase the fuel economy at these loads and speeds. It is hypothesized that the use of late intake valve close timing (LIVC) modulation could give an increase in volumetric efficiency from flow momentum. With an increase in volumetric efficiency, the open cycle efficiency (OCE) would increase. This would allow for improvements in the brake thermal efficiency (BTE). With the use of the engine simulator software GT-Power, the effects of IVC variation was explored to serve as a preliminary investigation for a variable valve actuation (VVA) engine in the future. The results from this investigation yielded an increase in volumetric efficiency through late intake valve closure (LIVC). While these findings have not been verified through experimental procedures, there could be a decrease in BSFC because the engine could breathe more efficiently, thereby reducing pumping losses.

KEYWORDS

Diesel, Efficiency, Variable, Valve, Timing