

Variable Valve Timing: General Options and Technologies

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Abstract

Variable Valve Actuation (VVA) is a main tool to enhance fuel economy, exhaust emissions and full load behaviour.

Variable Cam Phasing (VCP) is an excellent option to optimize all three characteristics together. According to the requirements within the engine map a "dual independent" phasing of intake and exhaust is the best solution. To realize this option also for a single camshaft valve train architecture, a new special "CamInCam" technology is presented.

The different VVA options are directly compared regarding fuel consumption by an analytical study with GT Power. The biggest potential is shown for cylinder deactivation and full variable lift/duration systems with a range of 7 – 12 % for the NEDC.

VVA is not only a "stand-alone" technique for SI engines, it is also a prerequisite for the use of new combustion systems like CAI (Controlled Auto Ignition). A novel kind of CAI system requiring internal & external EGR and using special variable lift/duration features for the control of internal EGR is presented. Compared to other systems this concept allows an extended CAI operation range, providing significant advantages in fuel consumption (10 % for the NEDC) combined with low NO_x emission.