Dynamically Downsized Gasoline Demonstrator Vehicle

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ABSTRACT

Gasoline engine downsizing is already established as a technology for reducing vehicle CO_2 emissions. Further benefits are possible through more aggressive downsizing, however, the trade-off between the CO_2 reduction achieved and vehicle drivability limits the level of engine downsizing currently adopted by vehicle manufacturers. This paper will present the latest results achieved from a very heavily downsized engine, and resulting demonstrator vehicle, featuring eSupercharging in combination with a conventional turbocharger.

The original 1.2 litre, 3-cylinder, MAHLE downsizing engine has been re-configured to enable it to achieve a BMEP level of 35 bar and a specific power output in excess of 160 kW/litre. Of key importance is a cost effective, efficient and flexible boosting system. The Aeristech eSupercharger, operating at 48 V, enables the transient response and low speed torque to be more than recovered, enabling both very high specific output and specific torque characteristic with excellent transient response and drive-ability characteristics, clearly demonstrating eSupercharging as a key technology for enabling further engine downsizing.

The resulting heavily downsized engine has been installed into a demonstrator vehicle that also features an advanced 48 V lead-carbon battery pack and a 48 V belt-driven integrated starter generator (BISG). The battery and BISG have been selected to enable the continuous high-output (6 kW) operation of the eSupercharger to support prolonged operation of the engine at low speed and high-torque output.

The fuel consumption of the resulting demonstrator vehicle has been analysed over a number of drive-cycles and the benefits of the downsized engine in conjunction with the complete mild-hybrid system have been assessed.