MEASURING THE CYLINDER-TO-CYLINDER EGR DISTRIBUTION IN A DIESEL ENGINE

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Large quantities of recirculated exhaust gas (EGR) may be needed to control NO_x emissions in future Diesel engines, possibly leading to cylinder-to-cylinder mal-distribution of EGR. In addition, engine transients could seriously aggravate the problem. As a result of a non-uniform EGR distribution, increased NO_x and/or particulate matter emissions could easily occur. In this work, we describe an optical diagnostic based on infra-red-absorption spectroscopy that can be applied to production-like engines to evaluate the cylinder-to-cylinder EGR distribution. We have applied this diagnostic to a small-bore Diesel engine and performed measurements under both steady-state and transient conditions. The IR absorption diagnostic is shown to have a very low detection limit along with high precision, and produces highly credible results. Both crankangle-, and cycle-resolved data were acquired in order to demonstrate the temporal measurement of the EGR concentration during the intake stroke, and during a sequence of cycles that define an engine transient. The results confirm the capabilities of the diagnostic, and in addition, illustrate interesting insight regarding the cylinder-to-cylinder EGR distribution.