EXTENDING EXHAUST GAS RECIRCULATION LIMITS IN DIESEL ENGINES

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This research addresses the application of high exhaust gas recirculation (EGR) levels to reduce engine-out NO_x emissions from diesel engines with a minimal penalty for unburned hydrocarbon and particulate matter emissions. The research objective is to develop an understanding of the fundamental relationships between EGR parameters, diesel combustion variations, and particulate formation so that options can be explored for maximizing the practical EGR limit, thereby lowering the performance requirements of post-combustion emission controls. Using the information derived from these relationships, an on-line combustion diagnostic or "virtual sensor" can be developed to provide active feedback for potential control strategies. A wide range of instrumentation was used to acquire time-averaged emissions and particulate data as well as time-resolved combustion, emissions, and particulate data. The results of this investigation suggest that there are three types of combustion variations that influence emissions at high EGR levels. These combustion variations must be accounted for in any diagnostic or control action.