

Abstract

The research presented in this thesis is focused on the development of methodologies for the real time parametrisation of the combustion process in direct injection diesel engines. The start point is the know how concerning pressure signal acquisition and combustion diagnosis using thermodynamic models, previously developed by the research group.

The research carried out is focused on two main topics. First, the design and development of the required tool for the acquisition and digital processing of the in-cylinder pressure, with the objective of improving the reliability and precision of the existing thermodynamic model used for combustion diagnosis. As a second step, it includes the development of new methodologies for combustion diagnosis based on the analysis of the in-cylinder pressure derivative.

Thus, the research includes the implementation of simple methods to identify the start and end of combustion and the maximum rate of heat release angles using only the in-cylinder pressure sensor signal. These methods have been validated in a wide range of applications, including real-time, on-line and off-line combustion diagnosis, and their applicability has been confirmed.

Finally, the research also increases the accuracy and reliability of the current combustion characterization methods, widening the possibilities of future development of control strategies based on real-time optimisation of the combustion process, which is expected to be a key aspect for the improvement of Diesel engines and pollution reduction.