

A One-Dimensional Modeling Analysis of the Influence of Swirl and Tumble Coefficient in a Single-Cylinder Research Engine

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Abstract : The stricter legislation and the greater demand of the population regard to gas emissions and their effects on the environment as well as on human health make the automotive industry reinforce research focused on reducing levels of contamination. This reduction can be achieved through the implementation of improvements in internal combustion engines in such a way that they promote the reduction of both specific fuel consumption and air pollutant emissions. These improvements can be obtained through numerical simulation, which is a technique that works together with experimental tests. The aim of this paper is to build, with support of the GT-Suite software, a one-dimensional model of a single-cylinder research engine to analyze the impact of the variation of swirl and tumble coefficients on the performance and on the air pollutant emissions of an engine. Initially, the discharge coefficient is calculated through the software Converge CFD 3D, given that it is an input parameter in GT-Power. Mesh sensitivity tests are made in 3D geometry built for this purpose, using the mass flow rate in the valve as a reference. In the one-dimensional simulation is adopted the non-predictive combustion model called Three Pressure Analysis (TPA) is, and then data such as mass trapped in cylinder, heat release rate, and accumulated released energy are calculated, aiming that the validation can be performed by comparing these data with those obtained experimentally. Finally, the swirl and tumble coefficients are introduced in their corresponding objects so that their influences can be observed when compared to the results obtained previously.

Keywords : 1D simulation, single-cylinder research engine, swirl coefficient, three pressure analysis, tumble coefficient

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