NUMERICAL MODELING OF COMBUSTION AND POLLUTANTS FORMATION IN CYLINDER OF DIESEL USING A DETAILED KINETIC MECHANISM OF N-HEPTANE OXIDATION

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Abstract: Based on three-dimensional unsteady Reynolds averaged Navier–Stokes equations coupled with different semiempirical turbulence models (k–ε, k–ξ–f, and hybrid turbulemce model), Lagrangian model of liguid-fuel spray and quasi-laminar combustion model with a detailed kinetic mechanism of fuel vapor oxidation and NOx formation, the calculations of diesel in-cylinder rotating flow with and without liquid fuel injection, with and without fuel combustion, are performed. The results of calculations are compared with the results of large eddy simulation and advantages and disadvantages of different semiempirical turbulence models were highlighted. The best prediction of such an important parameter of flow motion in the combustion chamber as a swirl number is shown to be provided by the hybrid turbulence model. Calculations with fuel combustion showed slightly overestimated values of wall heat flux, which is a reason for some disagreement between calculated and experimental curves for in-cylinder pressure and calculated and measured NOx concentrations.

Keywords: diesel; computational fluid dynamics (CFD); large eddy simulation (LES); detailed kinetic mechanism

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