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Investigation of Various Types of Liquid Fuel Atomization and Combustion Processes at High Turbulence

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Abstract: This study is devoted to the study of the influence of pressure and injected mass of liquid fuels on its evaporation and combustion processes. The octane and dodecane were used as liquid fuels in the researches. There was also constructed the model of the combustion chamber in a cylinder form. During the numerical simulation has been determined optimum combustion mode for two types of liquid fuel. Optimum pressure for octane was 100 bar and for dodecane was 80 bar. Optimal injection mass for octane was 6 mg and for dodecane was 7 mg. Numerical simulation results were compared with experimental data of various researchers. Also, for more visual description of the results of the octane and dodecane simulation processes other hydrocarbon fuels were investigated. It has been determined the amount of divergence from the simulation results of the experiment.

Key words: Atomization, combustion, turbulence, liquid fuel, internal engine, fuels

INTRODUCTION

One of complex challenges of thermal physics is the numerical study of the combustion of liquid fuels, due to accounting of a large number of complex, interrelated processes and phenomena. Therefore, numerical simulation is becoming vitally important in the area of study of combustion processes and design of different devices which use combustion process. Undoubtedly, in the future its role will increase. Having, opportunity to optimize some experiment on the basis of its virtual prototype making wide distribution of methods of computing hydrodynamics over the thermal physics. Obviously, in this days all problems arising in aerodynamics and hydrodynamics at the numerical solution of the equations of Navier-Stokes will be hardly solved. Therefore, due to the dramatic popularity of numerical studies in solving scientific and technical problems, it is necessary to ensure more possibilities of scientific and practical sides of this issue. Methods of mathematical modeling can be the most successful condition to solve practical issues in each subject area.

Improved prospects of wide using of methodology and the specific physical results in considered areas and also paths of more efficient application of methods of mathematical modeling which use the modern computer technology in various subject areas are realized by high level of researches achieved (Askarova *et al*., 2015a-d). It is observed that in recent years, produced 60 million cars that is approximately 165,000 cars produced per day, this is the relevance of using of liquid fuels. Now a days, car engines are significantly different from decades ago ones. The main combustion process in engines is the same but the types of injections are substantially different. For example, modern engines with electronically controlled injection system with air compression mechanism which enhances the combustion process, use only the required amount of fuel (Gorokhovski *et al*., 2010, 2012, 2014).

Thus, problems of saving energy and improvement of an ecological condition of heat-power object in many respects depend on the organization of high-quality combustion of fuel. However, considering that all available technologies of a fuel-preparation and combustions are practically perfect but the efficiency and ecological purity of package boilers in many cases are not well done, consequently, there is a problem of searching of new methods in the field. Simulation of the collapse, dispersion, evaporation and combustion of liquid fuel droplets under different initial conditions is relevant to solve this problems.

Introduction of new technologies requires the considerable expenses, therefore, increasing requirements

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