COMPUTER MODELLING OF THE MIXING OF GASEOUS FUELS WITH AIR PROCESS

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This work presents a numerical solution for the process of mixing gaseous fuels with air in the combustion chamber of an engine. The combustion parameters are influenced to a considerable degree by the characteristics of the mixture before its ignition. These characteristics can be influenced by the process of formation of the fuel and air mixture. Under certain simplified circumstances this process can be reproduced by means of commercially available software, and the results generated can be used for the optimisation of the engine performance.

Key words: *combustion chamber, injection, dynamic mesh, Fluent*

1. Introduction

The Department of Machines for Industrial Transport at the Technical University in Liberec has a long history of researching the combustion characteristics of gaseous fuels. As far as the preparation of the mixture is concerned, gaseous fuels are preferable to liquid ones. They allow for better mixing and easier maintaining of the fuel-air ratio resulting in a lower content of harmful substances in exhaust gases. They neither wash away the fuel film on the cylinder walls nor dilute the oil in the crankcase of the engine. They also do not form carbon deposits in the combustion chamber and have better anti-knocking characteristics than liquid fuels. Disadvantages preventing their wider utilization consist in difficult storage and distribution and in a low energetic density demanding a large built-up area for fuel tanks installed in the vehicle. However, demands for cleaner exhaust gases have created new efforts to employ gaseous fuels in the operation of motor vehicles. As a result, the current research programs are focused primarily on the combustion of natural gas and hydrogen; the latter showing great potential to become the fuel of motor vehicles of the future.

2. Numerical solution

The numerical solution of the flow is based on the Navier-Stokes equations averaged out according to Reynolds. The Reynolds equations (RANS) serve as the basis of turbulent flow mathematical models. However, the mathematical model consisting of the Reynolds equations only is not complete and must be supplemented with a suitable model of turbulence, approximating the Reynolds tensions. If modelling the process of gas mixing, the system of equations must be completed with the species transport equation. If a dynamic change of the mesh is used, it is necessary to solve the dynamic mesh conservation equation.

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