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NOx Prediction by Quasi-Dimensional Combustion Model of Hydrogen Enriched Compressed Natural Gas Engine

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Abstract : The dependency on the fossil fuels can be minimized by using the hydrogen enriched compressed natural gas (HCNG) in the transportation vehicles. However, the NOx emissions of HCNG engines are significantly higher, and this turned to be its major drawback. Therefore, the study of NOx emission of HCNG engines is a very important area of research. In this context, the experiments have been performed at the different hydrogen percentage, ignition timing, air-fuel ratio, manifold-absolute pressure, load and engine speed. Afterwards, the simulation has been accomplished by the quasi-dimensional combustion model of HCNG engine. In order to investigate the NOx emission, the NO mechanism has been coupled to the quasi-dimensional combustion model of HCNG engine. The three NOx mechanism: the thermal NOx, prompt NOx and N2O mechanism have been used to predict NOx emission. For the validation purpose, NO curve has been transformed into NO packets based on the temperature difference of 100 K for the lean-burn and 60 K for stoichiometric condition. While, the width of the packet has been taken as the ratio of crank duration of the packet to the total burnt duration. The combustion chamber of the engine has been divided into three zones, with the zone equal to the product of summation of NO packets and space. In order to check the accuracy of the model, the percentage error of NOx emission has been evaluated, and it lies in the range of ±6% and ±10% for the lean-burn and stoichiometric conditions respectively. Finally, the percentage contribution of each NO formation has been evaluated.

Keywords : quasi-dimensional combustion , thermal NO, prompt NO, NO packet
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