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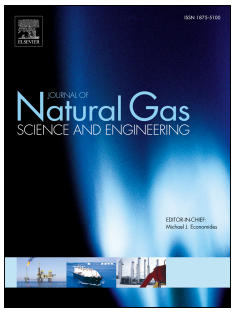

Numerical investigation of the impact of gas composition on the combustion process in a dual-fuel compression-ignition engine

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Numerical investigation of the impact of gas composition on the combustion process in a dual-fuel compression-ignition engine

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Keywords: dual-fuel engine, CNG, gas composition, simulation, zero-dimensional model, reaction kinetics

Abbreviations
ANN - Artificial Neural Network
CA – Crank Angle degrees
CI – Compression Ignition
CRDI – Common Rail Direct Injection
GEP - Gene Expression Programming
HCCI – Homogeneous Charge Compression Ignition
NG – Natural Gas
SI – Spark Ignition
TDC - Top Dead Center
CH_4 – Methane
C_2H_6 – Ethane
C_3H_8 – Propane
CO – Carbon monoxide
CO_2 – Carbon dioxide
NO_x – Nitrous oxides

Nomenclature and Units
[X] – molar concentrations of specific chemical compounds [mol/m^3]
Ea –Energy of activation [MJ/mol]
H – calorific value [MJ/mol]
N – number of moles [mol]
P - chemical Power of the introduced fuel [kW]
p –in-cylinder pressure [bar]
Q – energy from combustion [J]
T – in-cylinder pressure [K]
α – Crank shaft rotation angle [CA]
Φ – air/fuel ratio [-]

Subscripts
air – air
d – diesel fuel
g – gaseous fuel
i –individual combustible gaseous component (1 – methane, 2 – ethane, 3 – propane)
SOC – start of combustion

Abstract

This study discusses the model of operation of a dual-fuel compression-ignition engine, powered by gaseous fuel with an initial dose of diesel fuel as the ignition inhibitor. The study used a zero-dimensional multiphase mathematical model of a dual-fuel engine to simulate the impact of enhancing Natural Gas (NG) with other gases on the combustion process. The model simulated the thermodynamic parameters of the gas mixture in the cylinder of a dual-fuel (NG/Diesel),