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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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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
 CH₄ – Methane
 C₂H₆ – Ethane
 C₃H₈ – Propane
 CO – Carbon monoxide
 CO₂ – Carbon dioxide
 NO_x – Nitrous oxides

Nomenclature and Units

[X] – molar concentrations of specific chemical compounds [mol/m³]
 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),

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