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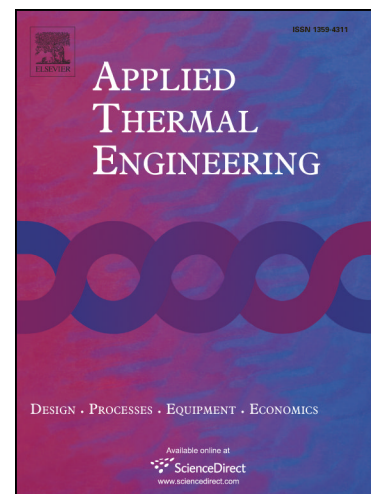
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The effects of turbine design parameters on the thermo-ecologic performance of a regenerated gas turbine running with different fuel kinds

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Abstract

This study presents exergetic performance of a gas turbine fuelled different fuel types such as ethanol, methanol, ethane, methane, pentane, propane, heptane, butane, hexane, octane, decane, nonane, undecane, tridecane, dodecane, tetradecane, hexadecane, pentadecane, benzene and toluene. Firstly, the fuel has the maximum exergy efficiency has been determined. The results demonstrated that the methane has the maximum exergy efficiency and the minimum exergy destruction. However, the methanol has the minimum exergy efficiency and the maximum exergy destruction. Due to the maximum exergy efficiency, the methane has been chosen to investigate the effects of turbine operating and design parameters such as inlet temperature, inlet pressure, turbine wall temperature, turbine length, turbine diameter, turbine speed, air mass flow rate, residual gas fraction, pressure ratio, equivalence ratio, heat transfer coefficient of the working fluid on the performance criteria such as effective power (EP), effective power density (EPD), ecological coefficient of performance (ECOP), exergy destruction (EXED) and exergy efficiency (EXEF) of the system. In the results, residual gas fraction, inlet temperature, heat transfer coefficient and turbine length affect the exergy efficiency negatively; the equivalence ratio, turbine speed, turbine diameter, pressure ratio, inlet pressure and turbine wall affect the turbine performance positively. However, air mass flow rate does not affect the turbine performance.

Keywords: Gas turbine ; Power density; ECOP; Exergy; Joule-Brayton cycle.

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