On-design operation and performance characteristic of custom engine

ABSTRACT

The purpose of this study is to investigate the design point performance of a custom engine via GasTurb software. In this study, a turbojet engine model is simulated without afterburners and limited to design point (DP) simulation at a speed of 15,000 rpm. The input parameters such as pressure ratio (PR) for the main components, the mechanical and burner efficiency, and isotropic PR for compressor and turbine have been identified for a custom engine as a design point. The results compared at different levels of the condition using GasTurb-13 and GSP-11 software. It was found that each software was able to provide similar results at various conditions tested. There are small differences in the values for the fuel flow and specific fuel consumption. Also, the same results were obtained at the baseline point. Furthermore, the heating value has a primary effect on specific fuel consumption. It was also found that the optimal thrust value was at 34.2 kN, and the best value for optimal specific fuel consumption was 20.9 g/kN.s. The main factors affecting biofuel properties are calorific value and viscosity. When the calorific value of the fuel is reduced, the thrust FN and specific fuel consumption increase. For example, Methanol and Ethanol recorded the highest amount of fuel consumption, which is 54.72 g/KN.s and 47.56 g/(KN.s), respectively. This is because they have the highest mass fuel flow (1.79 kg/s for Methanol, and 1.54 kg/s for Ethanol) than other types of fuel, while the mass fuel flow for green diesel (0.78 kg/s) was lower than other fuels, so its specific fuel consumption (22.11 g/(KN.s) was lesser than other fuels.

Keyword: Alternative fuel; Optimization; GasTurb; GSP; On-design; Aero-engine