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Thermodynamic Cycle Analysis for Overall Efficiency Improvement and Temperature Reduction in Gas Turbines

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Abstract : The paper presents a thermodynamic cycle analysis for three turboshaft engines. The first is the cycle is a Brayton cycle, describing the evolution of a classical turboshaft, based on the Klimov TV2 engine. The other two cycles aim at approaching an Ericsson cycle, by replacing the Brayton cycle adiabatic expansion in the turbine by quasi-isothermal expansion. The maximum quasi-Ericsson cycles temperature is set to a lower value than the maximum Brayton cycle temperature, equal to the Brayton cycle power turbine inlet temperature, in order to decrease the engine NOx emissions. Also, the power distribution over the stages of the gas generator turbine is maintained the same. In the first of the two considered quasi-Ericsson cycle, the efficiencies of the gas generator turbine stage. Also, the power distribution over the stages of the gas generator turbine is maintained the same. In the first of the two considered quasi-Ericsson cycle, the efficiencies of the gas generator turbine stages are maintained the same as for the reference case, while for the second, the efficiencies are increased in order to obtain the same shaft power as in the reference case. It is found that in the first case, both the shaft power and the thermodynamic efficiency of the engine decrease, while in the second, the power is maintained, and even a slight increase in efficiency can be noted.

Keywords : combustion, Ericsson, thermodynamic analysis, turbine
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