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Thermal Performance of Reheat, Regenerative, Inter-Cooled Gas Turbine Cycle

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Abstract : Thermal analysis of reheat, regenerative, inter-cooled gas turbine cycle is presented. Specific work output, thermal efficiency and SFC is simulated with respect to operating conditions. Analytical formulas were developed taking into account the effect of operational parameters like ambient temperature, compression ratio, compressor efficiency, turbine efficiency, regenerator effectiveness, pressure loss in inter cooling, reheating and regenerator. Calculations were made for wide range of parameters using engineering equation solver and the results were presented here. For pressure ratio of 12, regenerator effectiveness 0.95, and maximum turbine inlet temperature 1200 K, thermal efficiency decreases by 27% with increase in ambient temperature (278 K to 328 K). With decrease in regenerator effectiveness thermal efficiency decreases linearly. With increase in ambient temperature (278 K to 328 K) for the same maximum temperature and regenerator effectiveness SFC decreases up to a pressure ratio of 10 and then increases. Sharp rise in SFC is noted for higher ambient temperature. With increase in isentropic efficiency of compressor and turbine, thermal efficiency increases by about 40% for low ambient temperature (278 K to 298 K) however, for higher ambient temperature (308 K to 328 K) thermal efficiency increases by about 70%.

Keywords : gas turbine, reheating, regeneration, inter-cooled, thermal analysis
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