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Optimum Performance of the Gas Turbine Power Plant Using Adaptive Neuro-Fuzzy Inference System and Statistical Analysis

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Abstract : This study deals with modeling and performance enhancements of a gas-turbine combined cycle power plant. A clean and safe energy is the greatest challenges to meet the requirements of the green environment. These requirements have given way the long-time governing authority of steam turbine (ST) in the world power generation, and the gas turbine (GT) will replace it. Therefore, it is necessary to predict the characteristics of the GT system and optimize its operating strategy by developing a simulation system. The integrated model and simulation code for exploiting the performance of gas turbine power plant are developed utilizing MATLAB code. The performance code for heavy-duty GT and CCGT power plants are validated with the real power plant of Baiji GT and MARAFIQ CCGT plants the results have been satisfactory. A new technology of correlation was considered for all types of simulation data; whose coefficient of determination (R2) was calculated as 0.9825. Some of the latest launched correlations were checked on the Baiji GT plant and apply error analysis. The GT performance was judged by particular parameters opted from the simulation model and also utilized Adaptive Neuro-Fuzzy System (ANFIS) an advanced new optimization technology. The best thermal efficiency and power output attained were about 56% and 345MW respectively. Thus, the operation conditions and ambient temperature are strongly influenced on the overall performance of the GT. The optimum efficiency and power are found at higher turbine inlet temperatures. It can be comprehended that the developed models are powerful tools for estimating the overall performance of the GT plants.

Keywords : gas turbine, optimization, ANFIS, performance, operating conditions
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