Analysis of Gas Turbine Operating Parameters with Inlet Fogging and Wet Compression Processes

Sepehr Sanaye* **Mojtaba Tahani**

Energy Systems Improvement Laboratory
Mechanical Engineering Department
Iran University of Science and Technology (IUST)

Abstract

Inlet fogging has been widely noticed in recent years as a method of gas turbine air inlet cooling for increasing the power output in gas turbines and combined cycle power plants. The effects of evaporative cooling on gas turbine performance were studied in this paper. Evaporative cooling process occurs in both compressor inlet duct (inlet fogging) and inside the compressor (wet compression). By predicting the reduction in compressor discharge air temperature, the modeling results were compared with the corresponding results reported in literature and an acceptable difference percent point was found in this comparison. Then, the effects of both evaporative cooling in inlet duct, and wet compression in compressor, on the power output, turbine exhaust temperature, and cycle efficiency of 16 models of gas turbines categorized in four A-D classes of power output, were investigated. The results of this analysis for saturated inlet fogging as well as 1% and 2% overspray are reported and the prediction equations for the amount of actual increased net power output of various gas turbine nominal power output are proposed. Furthermore the change in values of physical parameters and moving the compressor operating point towards the surge line in compressor map was investigated in inlet fogging and wet compression processes.

Keywords: "Gas turbine, Inlet fogging, Wet compression, Power augmentation"

* Corresponding author: Sepehr Sanaye, Energy Systems Improvement Laboratory, Mechanical Engineering Department, Iran University of Science and Technology, Narmak, Tehran, Iran, 16488,
Tel-Fax: +98-21-77240192
E-mail address: sepehr@iust.ac.ir