Announcing the Final Examination of Mohammad Odeh for the degree of Master of Science

Time & Location: March 24, 2020 at 1:00 PM in Engineering 1 288
Title: Dynamic Modeling and Simulation of a Power Plant Steam Condenser on the Siemens SPPA-T3000 Platform

With rapidly increasing computational power, modeling and simulation of complex systems is gradually becoming the norm for evaluating and predicting performance. This research focuses on modeling and simulating thermodynamic behavior of condensers withinCombined Cycle Power Plants. This is particularly useful for power generation companies as this allows a wide range of operating conditions to be simulated and characterized without risking damage or the need to shut down the power plant, all of which results in losing revenue in the process. Moreover, being able to observe the thermodynamic evolution of the system provides useful insight into efficiency and response to perturbation.

To this end, a dynamic model of a condenser is developed using Siemens Power Plant Automation T3000 (SPPA-T3000), Siemens' proprietary plant monitoring software. The model is simulated using the geometry and specifications of a reference condenser provided by Siemens Energy Inc., along with operating conditions and multiple data sets for model validation. The condenser is modeled using lumped control volumes coupled by heat and mass transfer. Based on extensive literature survey, the model incorporates accurate and time-varying formulations of derived thermodynamic quantities and other heat transfer and fluid flow related coefficients, such as heat capacities, dynamic viscosity, thermal conductivity, and heat transfer coefficients, ensuring the simulation's validity over a wide range of operating conditions.

The model is capable of predicting and simulating both phase changes from steam to liquid water (condensation) and liquid water to steam (evaporation). The latter occurs, over short durations, when the condensate experiences low pressure above it. A switching mechanism is implemented to transition between different modes of operation and model the process of temperature change and mass transfer in each mode. The resulting simulation values for temperature and pressure agree with those provided by Siemens Energy Inc. for different operating conditions.

Major: Aerospace Engineering

Educational Career:
Bachelor's of Mechanical Engineering, BS, 2018, University of Central Florida

Committee in Charge:
Tuhin Das, Chair, Mechanical and Aerospace Engineering
Tian Tian, Mechanical and Aerospace Engineering
Ranajay Ghosh, Mechanical and Aerospace Engineering

Approved for distribution by Tuhin Das, Committee Chair, on March 9, 2020.

The public is welcome to attend.