ProTRAX®

Power Systems and Controls Unit

Innovative Solutions

AREVA's engineers who are familiar with plant processes and equipment are able to efficiently develop high quality, high fidelity models using the ProTRAX® simulation system. These system models can be used for verifying plant operator procedures or performing engineering analysis. The system is modular at the component level, allowing AREVA to interconnect to modules representing pumps, valves, superheaters, turbine stages, and condensers into any physically realistic configuration. All of the module formulations are based on first principles of conservation relations, the Second Law of Thermodynamics, and well-established constitutive relations for heat transfer and fluid mechanics. The resulting executable models are operated from a graphic-based environment which provides an extensive capability for controlling the models and displaying the results in various formats. The ability to coordinate multiple models so that they operate as a single large model allows construction of models with no practical size limit.

Applications

Plant operating procedures and engineering analysis are further enhanced by interfacing the model directly to control system hardware or to graphic emulations of the operator human-machine-interface (HMI). In addition, the use of features available through a dynamic entity option allows the user to customize a model interface, which may be configured to assess operating procedures for different plant applications.

Fundamentally, ProTRAX® is a tool for process and control system analysis and optimization of plant operating procedures. Many years of experience by organizations using the system all over the world demonstrate the usability of the tool; its continued use validates the usefulness of the results. This level of continued utilization is in part due to the continuing evolution of the code.

With the availability of models of control systems and Balance of Plant (BOP) systems, AREVA can build integrated models using existing RELAP5 primary (RCS) models. The integrated models will form the basis for control studies, system response studies, operational transients, and plant simulator support.

Specific applications that have recently emerged as possibilities include average temperature reduction evaluations (impact on BOP and resulting feedback to NSSS/RCS) and load following or load cycling studies.

Designing guidelines and identifying the causes of failure require an understanding of conditions in the plants. The legacy tools provide bounding conservative conditions for safety analysis, however do not deliver data of high enough resolution to determine the causes of failure.

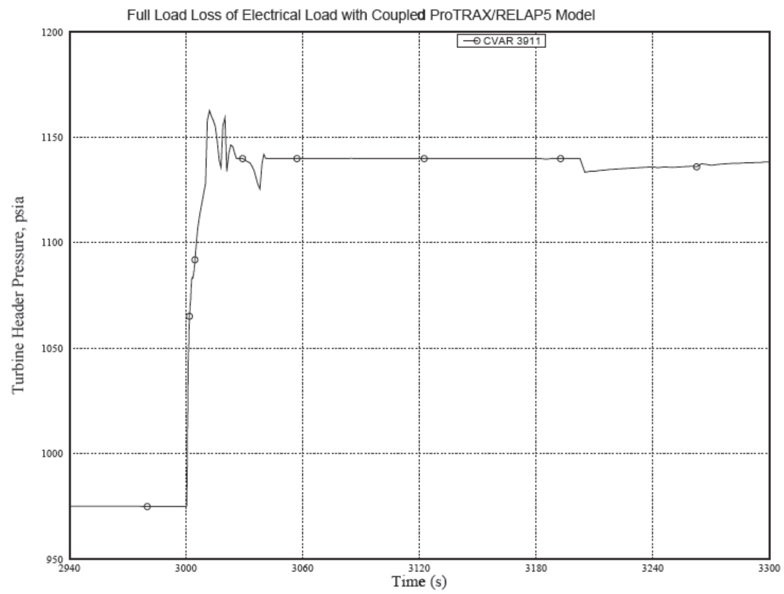
Features and Benefits

- Calculates pressures and the resulting flow rates
- Dynamically simulates the performance of valves and other control components
- Identifies operational "pinch points" such as feedwater heater drain valves that cannot handle the increased flow rates required as steam temperatures are decreased

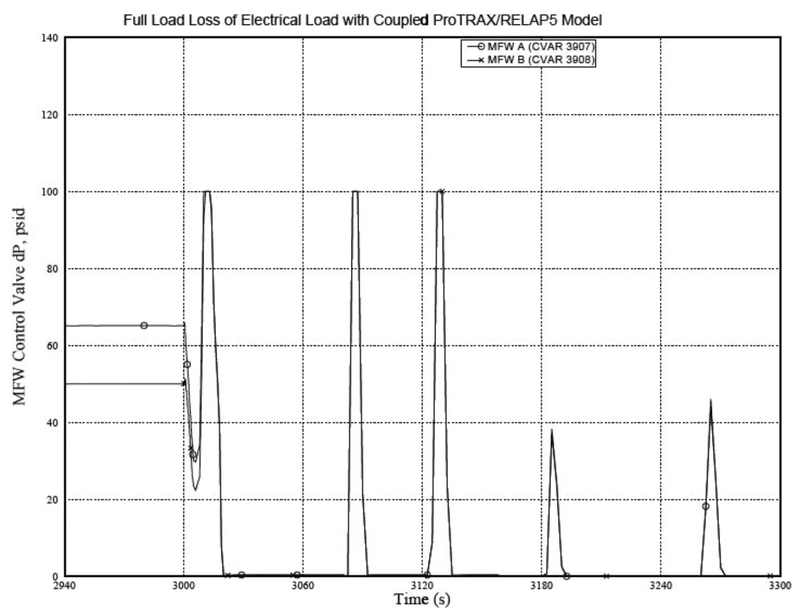
Results

Dynamic response of NSSS and BOP systems, like transient pressure drops on the turbine response, valve transient positions and the turbine speed and header pressure, main feedwater and condensate dynamic pump trips.

Turbine Head Pressure



MFW Control Valve Pressure Drops



AREVA Inc.
Corporate Headquarters
7207 IBM Drive
Charlotte, NC 28262

George Ifebuzo
NSSS Product Manager
Tel: 704.805.2649
Mobile: 704.330.3521
George.Ifebuzo@areva.com

Heshan Gunawardane
NSSS Product Manager
Tel: 434.832.2304
Mobile: 434.942.6316
Heshan.Gunawardane@areva.com