Ovation™ Advanced Power Applications Response Optimization

Features

- Increases unit maneuverability
- Stabilizes control during unit transient state through model-based predictive control
- Reduces thermal stress due to fewer temperature fluctuations
- Reduces control tasks allow for smoother operation of main components like pulverizers and FD and ID fans reducing plant operation costs
- Improves ramp rate 1-2%.
- Manages spray-water control due to changing fuel quality
- Corrects for temperature disturbances from steam enthalpy, steam flow changes, spray water valve position.

Introduction

Rapid ramping rates are critical to power utilities—faster ramp rates improve plant performance.

With optimized ramping capabilities, generating units will be able to maintain heat rate at a lower capacity, and will be able to avoid heat degradation, even when operating significantly below generating capacity.

Increased ramp rates, achieved through balanced coordination of boiler and turbine controls improve operational flexibility, maneuverability and profitability of generating units.

Goals

- Increase operational maneuverability
- Stabilize temperature fluctuations to reducing thermal stress
- Improve the stability of ramp rates
- Maximize the efficiency of startups and general plant operations
- Increase automated generation control (AGC) ability
- Eliminate overshoots
- Provide a higher level of stability and robustness in unit control during transient stages

Challenges

- Reducing plant operating costs through smoother operation of equipment like pulverizers and FD and ID fans
- Responding to unit dynamic load demands by calculating the proper amount of fuel and corresponding pressure response
- Forecasting key manipulated variables such as fuel flow for the boiler and the turbine control valve in a coordinated mode
- Maintaining stable operation at low load levels

Solution

Ovation response optimization solution, an advanced power application, uses advanced unit analysis and modeling techniques to provide optimal load trajectory and control for improved ramping, startup, unit turndown and overall performance. The response optimizer models process response and unit characteristics. The model calculates a variable derivative ramp rate to optimize plant maneuverability and AGC capabilities, eliminate overshoots and provide a high level of unit control precision.

Compared with conventional solutions, the Ovation response optimization application provides considerable improvements in control quality by using modern, model-based control methods. Model-based feed-forward control is combined with dynamic set point control for position control, main steam pressure control and fuel control. The application's feed-forward models are key to the output manipulation, while the PID controller tracks expected model response and corrects the feed-forward reaction.

The response optimizer responds to unit dynamic load demands by calculating the proper amount of fuel and corresponding pressure response. Internal dynamic models such as that for live steam pressure, unit load and chamber response allow the application to forecast key manipulated variables such as "fuel flow" for the boiler and the "turbine control valve" in a coordinated mode, allowing for quick and stable changes.

Examples of the non-linear dynamic process models that form the response optimization application include:

- Chamber response
- Fuel overshoot calculations
- Dynamic live steam pressure
- Superheater pressure drop response
- Valve movement pressure component/throttle pressure response

Project Execution

Emerson's implementation strategy for Ovation advanced power applications, including response optimization, centers on a proven methodology. A typical installation involves the following project implementation steps executed by our project team:

- Project kick off
- Installation of algorithms and controller licenses
- Project start
- Development of plant integration plan
- Execution of plant integration plan
- Data collection and conditioning
- Solution design and validation
- Installation of solution
- Advisory mode operation
- Closed loop mode operation
- Document / benchmark benefits and training activities

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