Power Generation

Background

"The power industry is moving to digital. First movers and aggressive digital adopters will be far more likely to thrive, not just survive."

Spiro MPC

Spiro MPC is a multivariable model predictive control application. The application comes embedded on a small footprint edge device, designed to connect to any control system easily. When embedded with Spiro MPC, the edge device is able to automate control of connected assets and can maintain processes at their optimal operating point.

Model predictive control case study: Utility boiler optimisation application

The unit under consideration was a 340MW, natural gas, tangentially fired, single furnace, Combustion Engineering boiler. The objective was to improve the unit efficiency (heat rate – Btu/kWh) without detrimental effect on greenhouse gas emissions from the boiler. A secondary objective was to reduce emissions of oxides of nitrogen (NO_x). Reducing unit heat rate would naturally achieve a reduction in carbon dioxide (CO_2) emissions per MW of generation.

The control solution was designed to reduce overall unit heat rate which is principally achieved by reducing air flows (excess oxygen) within the boiler and by maintaining superheat and reheat temperatures at their required operating target. To avoid compromising existing control of the boiler, the model predictive control scheme was designed to manipulate bias parameters to existing regulatory schemes. Figure 1 below shows the cause and effect matrix.

	O_2 Bias	Aux. Air Bias	Fuel Air Bias	A Level Bias	B Level Bias
RH Temp	x	x	x	x	x
S. SH Desup Spray Valve	x	x	x	x	x
N. SH Desup Spray Valve	x	x	x	x	x
Auxiliary Air Demand	x	x	x	x	x
FD Fan Demand	x	x	x		
Fuel Air Demand			x		
Stack Nox	x	x	x	x	x
Stack CO	x	x	x	x	x
Unit Heat Rate	x	x	x	x	x

Figure 1: Cause and effect matrix for utility boiler

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Benefits:
To verify the effect that the optimiser had on the process a separate verification test plan was produced. This plan simulated the normal unit load profile for a typical day. The same test of 10 hour duration was conducted twice on consecutive days; once with the new optimiser in service and once without the optimiser in service. The result of this evaluation showed a .35% reduction in unit heat-rate over all load conditions and a .55% improvement during steady load. The test results also showed an improvement in NOx emissions.

Spiro Analytics

Spiro Control offers a range of analytics applications that come ready installed on a small footprint edge device designed to connect to any control system easily and capture real-time plant data. Our data analytics applications can be used to analyse process performance, diagnose faults and to infer hidden properties without the need for expensive on-line analysers.

Massive amounts of data are generated, but all too often are not well analysed or made visible enough for useful decision support. The digital transformation of the power generation industry only serves to amplify this problem as the volume of data being created is increasing exponentially.

Part of the problem is that traditional approaches to analytics have built-in delays. For example, data may be stored in a data historian or data warehouse for days, weeks, or months before being analysed (if ever). Our solution is based on processing, analysing and responding to data right where it originates - at the edge of the network. Edge analytics allows data to be analysed in real time, immediately after the data is generated. Consequently, any issues in the production process can be identified quickly, alerts generated, and corrective action taken.

Because of the way our solution is configured it means that data applications can be easily used and customised by control and process engineers at site, not just data scientists and software specialists.

For more information, contact info@spirocontrol.com

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