

What is Process Control? and Why You Should Care - Interacting With The Physical World

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BACKGROUND

In process control, there is no software solution to a hardware problem.

A TYPICAL PLANT

A typical plant is composed of myriads of physical devices. Those related to process control are:

- 1- Primary, i.e., sensors/transmitters, and
- 2- Final Control Elements.

In a feedback control loop, the former sends information about the state of the controlled variable, and the latter, typically a control valve, throttles a flow to restore the controlled variable to its setpoint.

CASE STUDY

I went to work at a gas-fired power station that was having problems with the stability of the steam pressure.

Figure 1 shows that even with minimum movement of the controller output, the pressure has excursions of 100 psig.

It was impossible to ramp up the unit at the requested rates due to this issue.

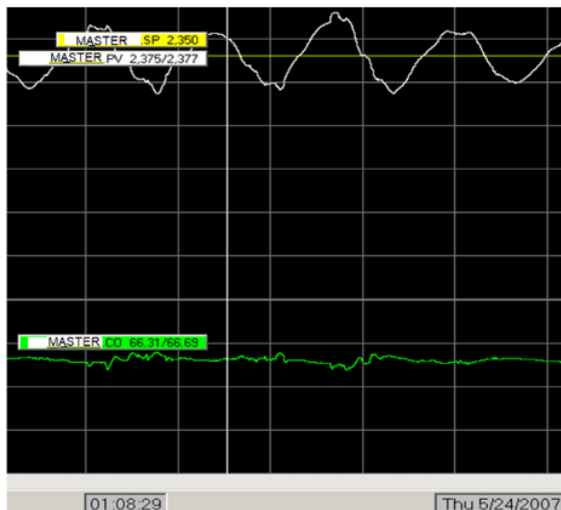


Figure 1 - Boiler Master Pressure oscillation

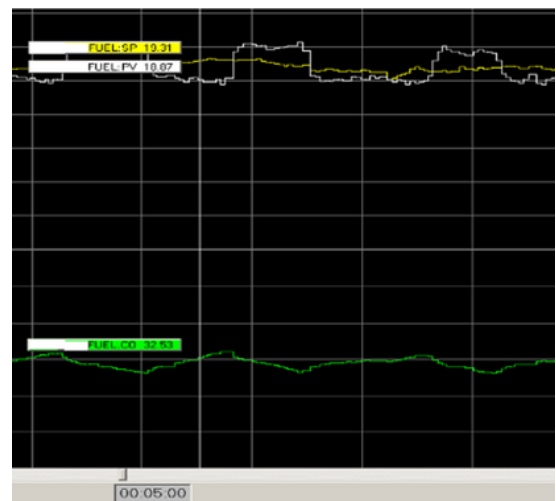


Figure 2 -Fuel gas flow control loop showing stiction. Yellow pen: Setpoint. White pen: Gas Flow. Green pen: Controller Output

MAIN PROBLEM

The gas valve had stiction. That is, the frictional force to be overcome to get the valve moving when its motion is hindered by the packing.

In Figure 2, I show how stiction manifests in the controlled variable.

WHILE INVESTIGATING THE PROBLEM

I found that several elements added to the combustion strategy, with the intention of resolving the oscillation caused by the valve stiction, were feeding the oscillation back into the boiler master control.

Intuitively speaking, it is like instructing the driver of a car to keep moving the steering wheel when the car is spinning out!

PROCESS CONTROL SOLUTION

By decommissioning the elements that kept feeding back the disturbances resulted in the reduction of the oscillation, and the ramping of the unit became easier.

The replacement of the valve, was the final solution to the stiction.

UNEXPECTED REQUEST

By the end of my visit, the production manager informed me that I would need to stay another week. His argument was that other consultants had been called in to address the problem, but their solutions worked fine while they were on site and would stop working the week after they left.

My answer was that I had actually done the opposite! I simplified the combustion control strategy. And that in my experience, control strategies should be as simple as possible, but not simpler, paraphrasing Einstein.

ECONOMIC BENEFITS

In the current electric grid configurations, the intermittency of the renewable energy sources requires fossil power generation readily available for speedy response to support the electric grid voltage, frequency and reliability requirements. How fast can a fossil power station ramp determines its saleability to the grid.