Automatic Control Systems:

Optimization can increase your bottom line

by Jacques Smuts

The vast majority of industrial processes have automatic controls – which, if not optimized, could result in significantly lower profits.

What is automatic control?

One of the best-known examples of automatic controls is the cruise control of a vehicle. The cruise control keeps the vehicle's speed constant, despite road gradient and wind direction. When we go uphill or downhill, the cruise control automatically changes the accelerator position to keep the vehicle's speed constant.

Similar to the example above, industrial processes have automatic controls that keep all aspects of the process at the design conditions, i.e. at the design temperature, pressure, flow rate, speed, chemical concentration, etc. At the core of an automatic control system is the controller.

What does the controller do?

The controller is the brain of an automatic control system. It monitors the process condition of concern via feedback from a sensor (measurement) and compares this to the desired value (setpoint). If there is a difference between the measurement and setpoint, the controller makes changes to a control element to bring the process back to setpoint.

An example of where humans act as controllers is when we regulate the water temperature while taking a shower. If the water is too cold, we open the hot water tap a bit and when the water is too hot we close it a bit.

Why optimize?

Industrial plants are built by contractors and the control system forms part of the scope of work. In most cases the personnel installing the controls are not skilled at optimizing them. The controllers are simply tuned to get the process up and running – leaving much room for improvement. Also, process dynamics change and maintenance issues occur during operation, which lead to the need for periodic optimization of the controls.

Referring to the shower example above, we all know how important it is to turn the hot water tap at the right speed. If we turn it too fast we will get burnt or chilled, if we turn it too slow we are wasting time and we will be uncomfortable for a longer period.

The benefits of optimizing industrial controls are numerous: Simplified startups and shutdowns; improved product quality – meaning less rework and waste; reduced raw material usage; increased production rate; decreased operating and maintenance cost, to mention just a few. An example worth mentioning is that of a critical controller that we optimized, now saving the client chemical usage of $150,000 p.a.

How are automatic controls optimized?

A controller has adjustable settings that determine the amount and speed of the change it will make to the process. If the controller reacts too fast the process will overshoot its setpoint. If the controller reacts too slow it will take too long to get to setpoint. Both of these could create dangerous and/or costly conditions (remember the shower example).

The controller should be optimized for the dynamics of the process it is controlling. Optimal controller settings are calculated using formulae or a computer program after analyzing data from a simple process response test. The optimization activity is done on-site and it normally takes about an hour per individual controller.