

Detecting and eliminating oscillations in industrial process control plants

Tore Hägglund

Department of Automatic Control
Lund Institute of Technology
Box 118, S-221 00 Lund, Sweden
phone: +46-46-2228798, fax: +46-46-138118
email: tore@control.lth.se

Many control loops in process control plants oscillate because of stick-slip motion caused by friction in valves, bad controller tuning, or because of oscillating load disturbances. These oscillations lead to quality problems and losses in production.

There are two main reasons for the presence of these oscillations. Firstly, they are often not discovered by the operators. Secondly, they may be difficult to eliminate, especially if they are caused by friction in the valves. In this presentation, two procedures to overcome these problems are presented.

To overcome the first problem, that the oscillations are not discovered by the operators, a procedure for automatic detection of oscillations in control loops is first presented. The procedure is based on the idea to monitor the magnitude of the integrated absolute control error, *IAE*, between successive zero crossings of the control error. The procedure is almost automatic in the sense that the only information required is the integral time of the controller.

To overcome the second problem, that the oscillations caused by friction in valves are difficult to eliminate, a procedure that compensates for friction in control valves is presented. The compensator adds short pulses to the control signal, in the direction of the rate of change of the control signal. In this way, the amplitude of the oscillations is reduced and the frequency of the oscillations is increased. This means that the effect of the stick-slip motion is reduced.

Both procedures are fairly simple and therefore easy to implement in industrial control systems. They have been implemented in many different control systems, and are currently in use in industrial process control plants. The implementation issue will be discussed, and several examples from the industrial use of the procedures will be presented. One example is the paper mill Frövi in Sweden, where the oscillation detection procedure is implemented in a Honeywell TCD300 system, and supervises over 91% of the control loops.