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Enhancing process performance through automatic control

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Enhancing process performance through automatic control

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The proportional integral derivative (PID) controller is the most dominant form of automatic controller in industrial use today. With this technique, it is necessary to adjust the controller parameters according to the nature of the process. Thus, for effective control of a pasteurisation process, for example, specific values need to be chosen for the P, I and D parameters, which will be different for the values required to control, for example, a distillation column. This tailoring of controller to process is known as *controller tuning*.

In general, when the process is commissioned, the PID controller is installed and tuned. However, surveys indicating the state of the art of industrial practice report sobering results. For example, in the testing of thousands of control loops in hundreds of plants, it has been found that more than 30% of installed controllers are operating in manual mode and 65% of loops operating in automatic mode produce less variance in manual than in automatic (i.e. the automatic controllers are poorly tuned) [1]. Process performance deteriorates when the controller is poorly tuned; this deterioration may be reflected, for example, in increased variation of the final product, increased waste (due to the product been off-specification), reduction in energy efficiency and increased environmental emissions. The net effect will be an increase in operating costs and a reduction in overall competitiveness.

The bioprocessing and pharmaceutical/chemical industries are key sectors in the Irish economy and currently experiencing unprecedented levels of change. In a recent report [2], greater emphasis on control and automation is suggested as a technological response of both the speciality chemicals and pharmaceutical sub-sectors to key business drivers up to 2015.

It is timely, therefore, to communicate the results of recent work by the author, who has collated industry-relevant PID controller *tuning rules* in a recent book [3]. The author will give a variety of process examples and will detail some directly applicable controller tuning rules in the contribution. Such tuning rules allow plant personnel to easily set up controllers to achieve optimum performance at commissioning. Importantly, they allow ease of re-commissioning if the characteristics of the process change (for example, due to wear on actuators and valves, or product and/or production modifications).

In summary, PID controller tuning rules can be directly implemented in the bioprocessing, pharmaceutical and chemical industries with minimal capital investment i.e. the hardware already exists, but it needs to be optimised. The outcome is directly measurable in, for example, reduced product variation, energy savings and reduction in waste. More fundamentally, since the PID controller forms the underlying layer in any enterprise-wide control system (Figure 1), it is vital that the PID controller is optimised if the upper layers in the hierarchy are to perform.

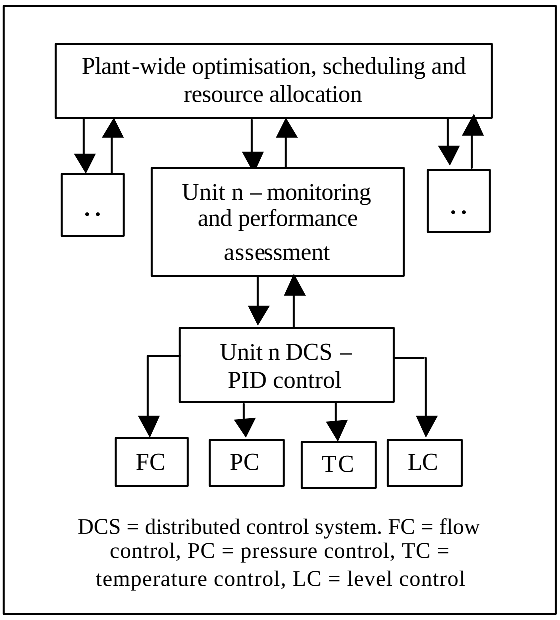

Figure 1: Hierarchical integrated enterprise wide control scheme

References:
1. Ender, D.B. (1993). Control Engineering September, 180-190.
2. Technology Foresight Ireland – Report on the Chemical/Pharmaceutical Panel (1999), Forfas, http://www.forfas.ie/icsti/statements/tforesight/chem/sectort.htm
3. O'Dwyer, A. (2003). Handbook of PI and PID Controller Tuning Rules, Imperial College Press, London.