

Enhanced dynamics – enhanced profits



Harvey Dearden suggests ways of squeezing the last drop of performance out of a process plant

Operators are usually adept at finding ways of providing smooth operation of plant (Photos courtesy of Merck)



MOST process plants are designed around nominated steady state operating points for which the process designer will establish corresponding mass and energy balances. Typically the process designer will then proceed to place basic feedback control loops around all the key process variables, the idea being to anchor the process at the nominated operating conditions. The instrument designer will then faithfully engineer the systems to provide the specified controls.

If competently executed, this approach will usually provide stable operation of plant. In terms of overall performance however, there are often many shortcomings, with unnecessary variability, poor rejection of disturbances, susceptibility to trips, sub-optimal operation and difficulty for operators.

You will often see this in excessive operating margins from trips, frequent operation in manual, bottlenecked production, increased reject/off-spec material levels etc. Operators are usually adept at finding ways to provide smooth operation of the plant, but this is often at the cost of productivity/yield/efficiency. 'Smooth' is usually a necessary but insufficient condition

for optimal operation. Because the process is generally perceived to 'operate OK', (ie, its producing), the costs associated with the missed opportunities are often overlooked, but they can be substantial – as a first indication perhaps 1–5% of operating expenditure. With say 10% margin this would potentially represent 10–50% of your profits!

The usual process performance guarantees relate to the nominated design operating points, so the issues I point to here tend to fall outside their scope. This in turn means that there are not the same incentives to pursue refinement of control strategies during the original design procurement phase.

I do not suggest that this is a deliberate 'manoeuvre' by design contractors, it is rather that the possibilities for enhanced control are often lost in the gap between process design and instrument design. The control system design tends to be centred on the steady state and proper consideration of dynamic concerns is often overlooked.

However, refined design of the control provision can deliver so much more, for example:

- **Enhanced capability for rejection of disturbances arising in utilities/services and up/downstream plant:** Disturbances arising in eg, heating or cooling services will often propagate into a process and cause variations in product quality.
- **Automatic co-ordination of multiple plant units and/or up/downstream plant:** Lack of effective co-ordination can give rise to unnecessary constraints on production.
- **Robust operation that reduces the load on operators and provides effective control under all operating conditions:** Eliminates the uncertainties and variable performance of manual operation.
- **Fully automatic migration to new operating points:** Eliminates manual intervention; minimises disturbances that might impact on quality or transient excursions that might risk trips or plant damage.
- **Reduced variability in key plant variables:** Keeps the plant closer to your nominated operating point, allows operation closer to constraints.

- **Automatically optimised performance that recognises the prevailing conditions:** Continuously drives the process towards the best operating point.

- **Intelligent provision for start up/shut down:** Establishes proper operating conditions as soon as possible, minimises excursions, avoids the uncertainties associated with manual intervention.

- **Recognition of process non-linearities:** Avoids the compromise in performance that is otherwise required to cater for the normal range of operating points.

The good news is that these considerations can usually be handled with conventional regulatory control techniques; no need to 'rip it all out and start again'. No need to dive into the 'advanced control technology' pool, which can bring its own hazards. Advanced technologies may well have a role to play in securing the most from your process, but first make sure you have exhausted the 'easy wins' from the conventional technologies which are simpler to implement, more intuitive to operate and easier to maintain.

Intelligent reconfiguration of the equipment you already have will probably take care of most of these issues. Some may require some further instrumentation or control equipment, but the investment levels are usually exceptionally low with payback periods measured in months rather than years.

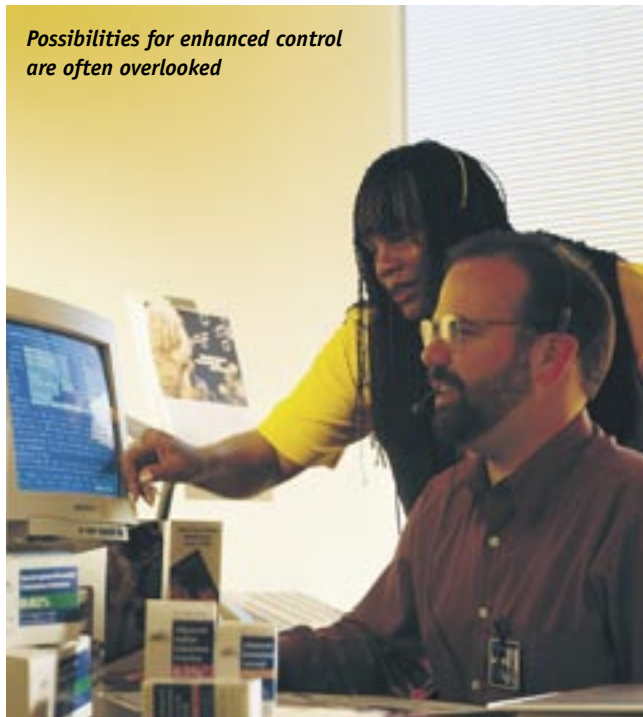
If you are uncertain whether these claims relate to your process, I suggest a quiet 'non-judgemental' chat with your operators will provide some insights:

what difficulties do you meet?

- What happens when the feed/fed or parallel unit trips?
- Do the standard operating instructions always make sense?
- Why is this loop in manual?
- When/where does the control system let you down?
- What stops you sailing closer to the wind?

Couch these questions in a sympathetic manner, in terms appropriate to your particular

Possibilities for enhanced control are often overlooked



operational context. You may be surprised at what your operators learn to live with.

You may also be surprised at apparent gaps in their understanding of the process and its effective operation as a business concern.

Whilst you are about it you can also consider related issues – the nuisance alarm rate, the number of standing alarms, the systems that are out of service. Look for ‘home grown’ labels or instructions stuck on panels – always a good clue.

Unobtrusively observe the way your operators ‘drive’ your process. Most operators drive by alarms; it is an exceptional operator that takes a proactive approach rather than a reactive one. Mimic displays may look very well, but they only give a snapshot of the process – they don’t in themselves tell you where the process came from or where it is headed. The key display for operators should be the trends; it is then immediately apparent when the process changes its behaviour, but these are usually reserved for post-excursion diagnosis. Intelligently configured trend displays should be the default operational display on your workstations.

Major investments are often made in upgrading to state-of-the-art distributed control systems, but the fundamentals of the process control strategies often remain substantially the same. The enhanced graphics and data handling capabilities may well be impressive, but the overall performance may well be compromised by the indifferent configuration of the control strategies.

A major virtue of such systems is their flexibility and the relative ease with which refined control strategies can be implemented; yet this is often under-exploited. The unfortunate result can be an ‘upgrade’ which is largely confined to cosmetic concerns. There are potentially significant benefits from enhanced ergonomics with improved displays and alarm handling, but it is a crying shame not to exploit the power in the control functions. A bit like having SatNav in your car, but only ever doing the school run. ■

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