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APC application ownership

Advancec process control (APC) requires skilled control engineers, and where such engineers are not available, even well-implemented APC applications quickly become ineffective. That much is known and has been published.[1–4] Feeling frustrated over the dire APC manning shortage, I wrote an editorial recommending simplifying APC to the point of giving up on some of the benefits, aiming to reduce maintenance requirements and improve the APC success rate. Another school of thought, represented best perhaps by Allan Kern, suggests that we do away with multivariable predictive control (MVPC) tools altogether, and move back to implementing APC strategies as DCS structures, going by the name of advanced regulatory control (ARC).

I do not share Kern's view against MVPC but think that complexity is the real culprit. Good intentions of capturing all of APC benefits have led control engineers to overly complex designs that might be beneficial with constant attention, but fall into disuse without attention. I have implemented many simple MVPCs, as well as ARC applications, and if you structure such an application with say, one inferential-quality model plus one override constraint without any built-in economics, it works day-in and day-out. If you wish to incorporate more constraints, especially constraints with slow dynamics and more economic considerations, MVPC is your tool, and that application requires almost daily attention to work well.

'Why?' Management asks. "We have paid a lot to develop APC, why do we need to invest more engineering time, and yet daily, to keep this application in good repair?" Complexity has something to do with it. Refinery economics can vary wildly. Seasonal or blocked-operation jumps are obvious and predictable, but there are other events that change economics quickly: delayed shipments, storms, equipment problems, troubles in a neighboring refinery, political unrest on a different continent or, in fact, any unforeseen event. Can the preconfigured MVPC economics cope with actual economics of the day? It absolutely cannot!

And how would a wise operator respond to a mismatch between refinery economics versus MVPC configuration? He/she would continue using valid APC functionality and disable offending functionality, usually by clamping manipulated variables (*MVs*). I have seen applications with 40 controlled variables (*CVs*) by 20 *MVs* where only two *MVs* were not clamped. Worse yet, operators are not expected to be aware of plantwide economics. With lack of guidance they might let APC drive the unit against the economics of the day, and what have we achieved then?; nice-looking multivariable responses that cause the refinery to lose money.

That is why economics-driven APC applications need daily attention. The site APC engineer should always be aware of current economic situations. While the engineer cannot quickly redesign the APC to follow current economics, he/she must find a way to set economic drive coefficients and *CV* targets to approach the real economics, and then instruct operators about how to work with these settings. That is what I call ownership. Being aware of refinery economics is perhaps a two-hour-a-week task, and figuring out how to make APC comply with current economics could take six more hours a week.

There's more to say about inferential control models. They are important because as APC moves the unit, keeping product qualities on target is key to correct optimization. I advocate inferential models based on first principles, whereas many APC practitioners employ regression-based models. That, in itself, is not a disaster. While the regression is necessarily inferior, a good process engineer can perhaps specify model inputs correctly to achieve workable models. Either way, inferential models require careful and detailed monitoring. As a minimum—track unbiased inferences against the lab to investigate inferential bias patterns, especially if it is related to operational modes. Upon seeing that the regression model no longer fits, the APC engineer should devote time to collect data and come up with another regression. That is perhaps a two-to-four-hour a week job, depending on the number of inferential models and their quality.

What about outsourcing APC engineering? In my view, APC ownership, i.e., the responsibility to monitor economics and inferential models, and to set the APC to agree with unit economics, should rest with the site engineer. But communications tools today certainly permit engaging a remote expert to help the site APC engineer set the application correctly, and/or to rework inferential models. I support inferential models in many refineries, though not to the point of daily attention.

The count of hours above leads to a simple conclusion that a good APC engineer can steward four major applications, five or six with outside help. If you cannot afford this level of engineering support—why spend money implementing APC to begin with? In that case implement only simple APC with quality targets and constraints but without economic drives. HP

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