An annotation:
NPRA 2002 computer conference

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I have participated in the NPRA computer conference without fail for over a decade, and have seen it going through the ebb and flow of oil economics. First, in the aftermath of oil company layoffs the conference participation shifted to become vendor heavy. Then, the severe downturn of instrument manufacturers, software suppliers and APC contractors has shrunk the attendance, coming down from 600 to around 200 people.

Several participants have expressed concern that these shifts would be detrimental to technical content, and it is true that many of the 2002 papers were overly commercial. However there were a number of scientifically informative papers, and the ensuing stimulating discussions during breakup sessions were also refreshing. Most importantly, my impression was that the 2002 attendees on average were of high caliber, and that is what counts for the success of any conference.

I would like to take the opportunity to highlight the papers and topics that appealed to my personal interest (Advanced process control (APC), modeling and optimization) and that presented relevant and interesting information.

Open Loop Modeling

IT presenters have often claimed that once you spend money on IT you immediately become a pace setter, (whatever that means) and your plant productivity has grown ten fold. It was refreshing to listen to a number of presenters who showed examples of decision support modeling applications that make money. Harpreet Gulati of Invensys gave an interesting paper in this category [1]. Simulations, dealing with live inputs have to reconcile the model against plant data, taking into account that there may be some gross errors in the measurements. Harpreet showed that the least squares method does not necessarily give the best reconciliation results because large instrument errors distort the outcome. Better results are obtained by limiting the maximum deviation penalty.

Closed loop optimization

In spite of bad press [2, 3, 4] people continued to present papers about on line optimization via the use of large steady state models. I have noted problems with this methodology years ago [3], and later suggested that the approach of using the LP part of their multivariable predictive controller (MVPC) as a Jacobian (partial derivative matrix), should work better [5]. In the past we heard several papers about direct optimization via the MVPC, and at this conference Citgo and Honeywell presented an interesting paper utilizing the method for optimizing an FCC unit [6]. I was listening to the presentation with mixed feelings though, because the technique requires good process models for generating partial derivatives, whereas Honeywell, having sold its process modeling division to KBC, had lost the ability to develop its own innovative technology.

Inferential models

Inferential models are the Achilles heel of APC. APC moves the unit against constraints, but if we do not have the ability to control product qualities – constraint pushing becomes counterproductive. The industry has applied largely empirical methods to infer product properties with mixed, mostly negative result. The conference dealt with the quality control issue in two papers: First – Invensys' approach, utilizing NMR analysis [7], and second – Petrocontrol's approach of first principles inferential models [8]. Both papers deal with crude units with difficult crude switches, and the conference provided a unique opportunity to compare the two approaches in terms of complexity, accuracy and price.
In addition to these two papers there was an information exchange session on inference modeling. I was one of the panelists, campaigning for first principle models against three other panelists who use mostly empirical methods. I may be biased though I think that at the end of the very informative discussion most people in the audience and on stage agreed that while empirical models are easier to develop, first principle models are better and require less laboratory support.

A note about Emerson

Emerson deserves a special mention because it is the only instrument vendor at the conference who demonstrated a vision and a plan. Most other instrument manufacturers only have layoff plans. While we disagree with Emerson's controller failure statistics, made to look bad to promote Emerson's Smart Sensors, we do agree that there is a need to detect control problems. Detection of unusual events, for example pump cavitation or sticky valves would permit taking corrective APC actions or at least stopping the incorrect actions. Such logic would help alleviate operator fear that upon unusual circumstances the APC would take a wrong action, which is the leading cause of service factor losses.
Granted that Emerson is an innovative instrument vendor, one wonders whether the DCS is the right place to install complex logic. Emerson's introduction of goodies such as neural networks, multivariable predictive control and others, into the DCS would make the DCS necessarily more cumbersome. Existing DCS's have certain advanced capabilities but I have rarely seen anything beyond a cascade or ratio applications working successfully. I would propose to Emerson to try install the sophisticated tools in a separate computer with good DCS interface.

Literature cited

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7. McFarlane R., “Improved real time optimization of a refinery crude unit”, NPRA computer conference, November 2002.
8. Singh P. et al, “Multivariable controller implementation for a refinery crude unit: a case study”, NPRA computer conference, November 2002.