TRANSACTIONS OF THE SPRING 2004 MEETING OF THE TEXAS TECH PROCESS CONTROL AND OPTIMIZATION CONSORTIUM

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http://www.che.ttu.edu/pcoc/

HIGHLIGHTS

- The presentations will be made available to the consortium members at the website, http://www.che.ttu.edu/pcoc/. Please contact Professor Hoo as (806) 742-4079 for login and password if assistance is needed.

- **Workshop & Panel Discussion**: The speakers and panel participants were David Hokanson (ExxonMobil), Walter Wrobel (Lyondell), Steve Finlayson (AMT), Dave Hoffman (CCI), and Charles Cutler (CutlerJohnston). Each provided their viewpoints on Controller Benefits and Justification. Their presentations are available at the website to member companies. A video tape of the workshop is available to member companies.

- **The first presentation**, "Model-Free Adaptive Control" by George Cheng (Cybosoft). George presented an introduction to model-free adaptive control and discussed a number of industrial projects including pH control. Model-free adaptive control provides custom-built regulatory control function for highly nonlinear processes and/or non-stationary processes.

- **The second presentation**, "Multivariable Controller Monitoring for Operators" by John Szuhay (Bay Systems). John presented his software product MPCScope™, which is designed to assist operators in understanding the performance of DMCPlus™ controllers. MPCScope™ provides the operator several handy graphical and tabular tools that make it easier for the operator to follow and maintain model predictive control applications.

- Dale Slaback presented his Phd dissertation work on "A Surrogate Model Approach to Refinery-Wide Optimization". His work uses RTO models with fixed physical properties to improve the computational efficiency of refinery-wide optimization. He was able to demonstrate a factor of 9:1 speedup using his approach. Projection to a full-scale refinery-wide problem with 150 decision variables indicates that the CPU would be less than 2 hours using his approach.

- Eric Vasbinder presented his PhD dissertation research on "A Decision-Based Approach to the Integration of Chemical Process Design and Control Structure Synthesis." Inthis work, he developed a novel and systematic approach to the design of plantwide controllers with the objectives of : i) addressing the dimensionality of the problem and ii) prioritizing among the multiple design, operational, and control objectives. The approach first determines the best set of modules, comprised of the existing unit operations found in the process flowsheet, that

addresses the design and operational objectives using a decision-based method, the modified analytic hierarchical process (*m*AHP). Second, a control structure addressing the attenuation of disturbances is synthesized and validated for each module. The third and final step is to combine all the modules and their control structures and verify that together the performance of the plant and the control structure is stable and satisfactory. He demonstrated the approach on a complex chemical process flowsheet that produces benzene by the de-alkylation of toluene.

- Rohit Kawathekar presented his Phd work on "Nonlinear Model Predictive Control for a Reactive Distillation column." His work shows a factor of 2 to 3 improvement the control of a highly nonlinear reactive distillation column using NLMPC compared to PI controls.

- Karlene Hoo presented an overview of her research program. Highlights included: Zdravko Stefanov's fundamental model of an entire multiple effect evaporator plant complete with model-based control; experimental results of the work by C. Dewey Buescher on non-Newtonian fluid flow in a collapsible tube with internal membrane structures; and numerical results of Vikram Shabde on numerical solutions of moving boundary problems with application to the production of micro-hollow particles from a spray drying process. For publication references see http://www.che.ttu.edu/pcoc/pubs/publications.htm

- Jim Riggs presented an overview of his research program. He discussed the significance of the refinery-wide optimization study, nonlinear MPC applied to a reactive distillation column, and a new effort to develop software tools to assist engineers to effectively maintain RTO projects.

- There were representatives from the seven of the eight sponsors and eight visiting companies in attendance at the meeting. The visitors included Lyondell, Honeywell, Aspentech, ABB, Bay Systems, Cybosoft, Open Matrix Technologies, and ExxonMobil.

- The next workshop will be on "MPC Maintenance."

ATTENDANCE

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