ADVANCED PROCESS CONTROL IN INDUSTRY: *THE CASE OF GLASS MANUFACTURE*

Yu Jiao[1], James Finley[1], and B. Erik Ydstie[2]

[1] *PPG Industries Inc. Glass Research and Discovery Center*
400 Guys Run Road, Harmar, PA 15024, {jiao,finley}@ppg.com

[2] *To whom all correspondence should be addressed Department of Chemical Engineering, Carnegie Mellon University, Pittsburgh, 5000 Forbes Avenue, PA 15213,* ydstie@cmu.edu

Abstract:

A unified strategy for process control system design has been applied and refined over a period of 25 years. The approach is based on "three pillars" - the Measurement (Instrumentation), Learning (Data/analysis), and Action (Control) systems. Such high level decomposition allows systematic project management of process control project teams that typically consist of 5-10 engineers led by corporate research. APC tools that have been applied within the framework include nonlinear passivity based control, stochastic adaptive control, multivariable predictive control, optimization for improved production scheduling and PCA/PLS. How these tools are integrated within the DCS and ARP systems is more important than the tools themselves since we strive to form complete control solutions that address business objectives. Industrial applications include flat glass production for architectural applications, glass bending for the automotive and aerospace industries, a variety of low-e coating processes and fiberglass drawing. Such processes are described by nonlinear and hybrid differential equations distributed in space and time, there are stochastic disturbance inputs, long delays and the time-scales range from milliseconds to several hours. Many key process parameters must be controlled to tight tolerances to achieve desired product specifications. The main contributions of the paper are (1) describes a unified strategy for control design and (2) it demonstrates clearly the economic benefits of APC when it is applied in industrially.

Keywords: Benefits of control, distributed control, decentralized control, nonlinear control, passivity based control, model predictive control, adaptive control.