

Special Session 6

Advances and Current Problems in Process Control :

A Review

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Abstract

Interest in process control has rebounded from an all-time low in the mid-1970s, with a new focus on bridging the gap between academic theory and industrial practice. Since then, much progress has been made in the new generation of process control theory to bridge this gap. This review summarizes the recent advances and current problems in process control on a qualitative level.

Summary

Chemical processes exhibit many characteristics that cause control difficulty. Practitioners were disenchanted with modern control theory of the 1960s and 1970s, because the so-called modern control theory was of very limited usefulness for handling many of challenging control problems. This optimal control was also judged to be inappropriate in view of more important problems, such as the selection of the control structure and the effects of process design on operability. On the other side of the fence, probably the most innovative industrial developments, namely distributed computer control and energy management, were made in the 1970s. There was, however, the lack of coordination between academic and industrial research, causing interest in process control in the mid-1970s drop to an all-time low.

In spite of this rather dismal view of the potential commercial value of previous process control research results of the 1970s, a decade later it is encouraging to note that in the 1980s both academia and industrial sectors have been pursuing more research areas in common than occurred in earlier decade. This change is believed to be motivated by the publication of the three insightful critiques that analyzed the gap between academic theory and

industrial practice. These critiques also have helped us put the theoretical developments of the past decade into the proper perspective, and develop a new generation of process control theory that could impact industrial control practice. As a result, the 1980s has seen significant developments in process control theory, combined with advances in control system hardware and software that have allowed the use of advanced feedback control strategies that were not previously possible. Moreover, industry realizes that excellent payoffs can be achieved from process control projects in terms of increased productivity and efficiency, causing industry to be more receptive to advanced control concepts.

Recent research efforts have concentrated on providing control system design techniques to handle many of the process characteristics. These techniques include adaptive control, model predictive control, robust control, nonlinear control, control structure selection, integration of process design and process control, and expert systems and fault detection. They appear to be great promising for practical applications. In this review, common process characteristics that must be handled by control are to be briefly pointed out. Then, process control research and development trends in academia as well as in industry will be discussed on a qualitative level, along with the recent advances in process control theory. A personal perspective on current process control problems will be presented.