Industry Applications Society
Control Systems Society Joint Chapter of Spain

Introductory Course - Adaptive Predictive Expert Control

This course presents the methodological principles of predictive and adaptive predictive control and how to apply ADEX controllers within the ADEXCOP software platform for industrial applications

Aimed at

- Teachers of industrial control principles.
- Graduate students and researchers in the area of advanced control.
- Professionals involved in control and process optimization.
- Technical specialists in instrumentation and control.
- All those interested in improving knowledge of Advanced Control Systems, specifically predictive, adaptive predictive and adaptive predictive expert control systems.

Material Provided

- Course Manual: information on all course topics, including the user screens, user manual, ADEX Toolkit and guidance practice in simulation.
- Book “Adaptive Predictive Expert Control: Methodology, Design and Implementation”, published by the Universidad Nacional de Educacion a Distancia (UNED) in 2005.
- Demonstration system software platform ADEXCOP Control and Optimization.

General information

Duration: 2 days, from 09:00 to 13:30 and from 15:00 to 18:30
See next dates.

Centro de Empresas “La Arboleda”, inside the Campus Sur UPM. Ctra. de Valencia, Km. 7,300 – 28031 Madrid. See map.

Tel.: 913327792
Email: ias-css.Spain@ieee.org

Course objectives…

- Understanding of the methodological principles of Adaptive Predictive Expert Control.
- Ability to develop control strategies based on Adaptive Predictive Expert Control using ADEX COP.
- Understand the principal components of the system - driver block, adaptive mechanism and expert block designs.

Related link

- Capítulo conjunto IAS-CSS

Course Syllabus

- ADEX Control:
  - Adaptive Predictive Expert Control Systems.
  - Conditions of Stability.
  - Block Design Driver.
  - Adaptation Mechanism Design.
  - Control and Optimization platform ADEXCOP
  - Simulation Practice.

Reservation and Tuition

The cost of the course is 800 Euros (+16% IVA). Payment by bank transfer to: BARCLAYS Bank, Account Number 0065 0200 53 0001016608, C/ Cantalejos, 9, Madrid 28035. Transfer should note “Curso ICAPE”.

Send proof of payment and the enrollment form together to ias-css.Spain@ieee.org or fax nº 91 305 31 84.

20% discount for IEEE members.

50% discount for students.

Industry Applications Society
Control Systems Society Joint Chapter of Spain

Introduction

The principles of predictive and adaptive predictive control were introduced in the seventies and subsequently over more than two decades of research and publications these have been further refined to a high level. In the context of Predictive control, without adaptation, where the predictive model must be obtained prior to the control application, several alternatives were proposed, and are currently in commercial use mainly in the petrochemical industry.

However, the performance of predictive control with a fixed parameter model may deteriorate when process parameters change and a model mismatch is produced, as has been observed in practice. Thus, adaptive predictive control appears as a solution theoretically able to offer a better approach to the inherent time-varying dynamic nature of the process. After a quarter of a century of theoretical and practical research in this area, has adaptive predictive control as a tool for industrial control reached maturity ? What are the Strategies that have been proposed and successfully used in practice? Has the the controversy between adaptive control and expert control been overcome in industry ?

The present course “Introduction to Adaptive Predictive Control” provides an answer to these questions and didactically presents the new generation of adaptive predictive control, which integrates the basic principles of expert control integrated within the methodology and is called ‘Adaptive Predictive Expert Control ADEX’.

ADEX combines Adaptive Predictive Control with Expert control by defining domains of operations for each of them in an integrated setup. The evolution of process variables determines if Adaptive Predictive Control or Expert control must be applied to the process according to the corresponding domain of operation, which guarantees the robust and satisfactory performance of ADEX controllers in any industrial environment.

The ADEX controller configuration is extremely simple and its implementation is carried out with the integrated plant control system through the automatic installation of the Platform ADEX COP (acronym for “ADEX Control & Optimization Platform”).

Also, this platform is designed to develop logical schemes that use drivers to set ADEX Control Strategies and Optimization (ECO) for optimized control of critical process variables.

ADEX controllers can be used to substitute traditional PID controllers, thereby simplifying the task of adjusting and improving the process operation. They can carry out robust, multivariable control with precision, stabilizing the process evolution, and allowing variables to guide their optimal operation points.

The course provides in-depth coverage of the concepts previously described. Moreover, there is much emphasis on the active participation of students through using simulated digital applications, and the course is also illustrated by industrial applications of the adaptive predictive expert control technology using the ADEX COP platform.

Course Program

Theme 1 – Course Introduction: Historical evolution of industrial process control. Adaptive predictive control, expert control and adaptive predictive expert control basic concepts. Methodology and application examples.

Theme 2 – Adaptive Predictive Control Systems: Predictive control, adaptive control and adaptive predictive control. Block diagram and basic equations. Adaptive predictive model of the two functions. Stability Conditions for the driver block and adaptive mechanism designs. Experimental applications.

Theme 3 – Driver Block Analysis and Design: Basic strategy of predictive control. Driving and projected desired trajectories. Basic strategy limitations. Predictive control extended strategy. Prediction Horizon. Stability conditions verification. Structure variables. Experimental applications

Theme 4 – Adaptive Mechanism Analysis and Design: Design principles based on System Stability theory. Lyapunov’s stability. Ideal case, asymptotic stability. Real case, global stability. Stability conditions verification. Structure variables. Experimental applications.

Theme 5 – The ADEX COP software platform for the control and optimization of processes, platform utilities: processor, supervisor and simulator. Software structure. Definition of inputs/outputs. Control and Optimization Strategy (COS) design. Configuration of the expert, control, and driver blocks, as well as the adaptive mechanism of ADEX controllers. ADEX application using Windows and embedded control systems actively being used in industry (PLC and DCS). Experimental application and evaluation. Course conclusions.