Advanced Control Engineering: Academia - Industry

Report of Contributions

Contribution ID: **5** Type: **not specified**

Recent advances in PI/PID tuning

PID control is well known as the dominant field feedback controller.
Its simplicity, low number of parameters and acceptable performance levels even with “hand tunning”has made it the preferable option by most of the plant operators. During the last decade, some new perspectives o PI/PID tuning have raised that provide a more holistic and global view of the controller tuning procedure. The talk will succinctly provide some examples of new approaches highlighting who they take into account different (and conflicting) figures of merit that evaluate the performance of the resulting control system.

Presenter: Prof. VILANOVA, Ramon (Universitat Autònoma de Barcelona - Spain)

Contribution ID: **6** Type: **not specified**

Overview of Model Predictive Control

Model Predictive control (MPC) is a modern control technique that has gained high acceptance in industry due to its capability of dealing with large multivariable processes where demanding specifications and constraints must be met in spite of disturbances and operation changes. The talk gives an introduction to the fundamentals of this control technology, covering from basic concepts and algorithms to implementation methodologies and tools. The content is illustrated with practical application examples, showing the current trends that link MPC to the field of optimal economic process operation.

Presenter: Prof. DE PRADA, Cesar (Universidad de Valladolid - Spain)

Contribution ID: **7** Type: **not specified**

Multiobjective optimization for engineering design

Engineering design problems usually require the satisfaction of several objectives. In most cases there exists conflict among design requirements and, thus, the solution to the problem is not either unique or trivial. In fact finding a tradeoff solution for these multiobjetive optimization problems (MOP) is a crucial and time consuming task that the designer must carry out. Obtaining a design alternative as closer as possible to the designer preferences, requires the fulfillment of three essential steps: MOP statement, optimization process and decision making. In this talk, the general framework will be stated and several tools to assist designers in each step will be presented. In addition, application examples in engineering design, model identification and controller tuning will complement the explanation.

Presenter: Prof. BLASCO, Xavier (Universitat Politècnica de Valencia - Spain)

Contribution ID: **8** Type: **not specified**

CERN Industrial Control

Presenter: Dr GAYET, Philippe (CERN)

Contribution ID: **9** Type: **not specified**

Model Predictive Control applied to the LHC magnets temperature control

The LHC superconducting magnets are operated below a temperature of 1.9 K along a circumference of 27 kilometers. The temperature of these magnets is a control parameter with very strict operating constraints. The presentation addresses the different approaches taken to overcome the complexity of the process and introducing a nonlinear control approach based on a predictive control technique which includes a constrained nonlinear state estimator with a receding horizon estimation procedure to improve the regulator predictions.

Presenter: Dr BLANCO VINUELA, Enrique (CERN)

Contribution ID: **10** Type: **not specified**

Control and simulation of cryogenic plants at CERN

CERN is operating the largest helium cryogenic installations of the world to maintain the 40 000 tons of the LHC at 1.9 K. To control these industrial plants, around 80 PLC (programmable Logic Controllers) are used handling more than 40 000 Inputs/Outputs. The PLC are also embedding around 5 000 PID regulation loops to maintain temperatures, pressures and flows at desired values. In these context, some advanced regulations techniques such as IMC (Internal Model Controller) or optimal controllers have been tested and validated through sophisticated modelling and simulation tools to improve the different control strategies in future.

Presenter: Dr BRADU, Benjamin (CERN)

Contribution ID: **11** Type: **not specified**

High precision current control of the LHC Power Converters

The LHC requires a very high precision (a few ppm) in the control of the superconducting magnet currents. To reach this challenge a digital RST current loop has been developed to control the LHC power converters. This talk presents the RST theory and its application to the power converter control.

Presenter: Mr THIESEN, Hugues (CERN)

Contribution ID: **12** Type: **not specified**

Design and Performance of the LHC beam-based Feedback Systems

The LHC deploys a comprehensive suite of beam-based feedbacks for safe and reliable machine operation. More than 3500 devices, distributed over the 27 km circumference, are involved in these feedbacks, making them one of the largest and most complex systems at any present or previous high-energy accelerator. This contribution evaluates the underlying feedback control loop architecture, its operational performance –strongly linked to the associated beam instrumentation, external beam perturbation sources and optics uncertainties –and compares them with the initial feedback design assumptions.

Presenter: Dr STEINHAGEN, Ralph (CERN)

Contribution ID: **13** Type: **not specified**

Formal methods applied to PLC code verification

PLCs are the most widely used control devices for industrial processes. Ensuring that PLC programs are compliant with the specifications is a challenging task and a highly recommended practice, especially for Safety Critical Systems. We propose a methodology for applying automated model checking to PLC programs hiding completely the complexity of using formal methods to PLC developers

Presenter: Mr FERNANDEZ ADIEGO, Borja (Universidad de Oviedo (ES))

Contribution ID: **14** Type: **not specified**

Visual data analytics applied to industrial processes

The emerging field of visual analytics (VA) relies on combining intelligent data algorithms (IDA), visualization principles and interactive interfaces, amplifying human cognition to tackle problems that involve large datasets and non-explicit problem domain knowledge. We believe that the VA is a powerful approach for process analysis and optimization thanks to its ability to communicate information to the user in effective and insightful ways, where the user takes active part in the analysis process through visual exploration.

Presenter: Dr DIAZ BLANCO, Ignacio