Editorial

Special section on Nonlinear Model Predictive Control

This special section includes four articles, which are extended versions of the plenary lectures presented by the well-known researchers David Q. Mayne, Panagiotis D. Christofides, Rolf Findeisen and David Angeli at the 5th IFAC Conference on Nonlinear Model Predictive Control (NMPC'15) held in Seville, Spain on September 17–20, 2015. The NMPC tri-annually brings together researchers in the area of model predictive control, from both academia and industry. This event has been sponsored by the International Federation of Automatic Control (IFAC) through the Spanish Committee CEA-IFAC with the support of the Non-linear Control Systems Technical Committee.

The series of conferences and workshops on Nonlinear Model Predictive Control has already had a long and rich history. This event is the 5th meeting on the assessment and future directions of Nonlinear Model Predictive Control since 1998. The first conference in this series took place in Ascona, Switzerland in 1998; followed by the conferences in Freudenstadt-Lauterbad, Germany in 2005, the conference in Pavia, Italy, 2008 and the conference in Noordwijkerhout, the Netherlands in 2012. Since the 4th edition, this meeting has been held as an IFAC conference. In our opinion, one of the main reasons for their success is its singular conference policy: a single session track in a common lodging venue for all the participants. The conference becomes a place in which it is easy to meet all the participants and get involved in great discussions. We are glad to see the continued strong interest towards the conference topic and its program as reflected by the number of high-quality contributions and the steady increase of the number of participants. The proceedings of the workshop can be consulted in IFAC-PapersOnLine.

The first article is entitled "Robust and Stochastic Model Predictive Control: Are We Going in the Right Direction?" by David Q. Mayne. In this paper, Prof. Mayne emphasises that many proposals for robust and stochastic model predictive control are probably too complex for current implementation in the process industries and he suggests several possible simplifications based on nominal predictive control with tightened constraints which are determined offline using, possibly extensive, stochastic optimization.

The second article, entitled "Economic Model Predictive Control: Elucidation of the Role of Constraints", by Matthew Ellis, Helen Durand and Panagiotis D. Christofides, focuses on economic model predictive control and the role that the different constraints imposed in the optimization problem to provide guaranteed closed-loop properties play in this class of controllers. The authors provide a nice review of the work of others in this field and

then summarize their own efforts based on appending Lyapunov-based stability constraints to the algorithm.

The third article, authored by Sergio Lucia, Markus Kogel, Pablo Zometa, Daniel E. Quevedo and Rolf Findeisen, is entitled "Predictive Control, Embedded Cyberphysical Systems and Systems of Systems – A Perspective". It presents an overview on the role that predictive control may play in the broad topic of interconnected systems that exchange information via communication networks. In particular, the paper focuses on three important issues: resource awareness, embedded implementation and modularity. The authors briefly summarize results from these fields and outline some ideas with respect to the appearing challenges from their work including event triggered predictive MPC comparing to a fictitious closed loop system, an automatic code generation tool specifically designed for linear MPC for embedded platforms and a contract-based distributed MPC.

The fourth article "Theoretical advances on Economic Model Predictive Control with Time-varying Costs" by David Angeli, Alessandro Casavola and Francesco Tedesco, illustrates how the Economic MPC paradigm can be adapted in order to accomodate both a priori known time-varying costs (periodic or admitting an asymptotic average) and parameter varying costs. The different solutions and performance bounds are compared by means of a simple case study where all the different approaches have been tested.

The four papers address diverse topics in model predictive control and we think they provide a great overview of the current state-of-the-art and focus the future development of the field towards relevant directions.

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