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GUEST EDITORIAL

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Editorial Model Predictive Control for Energy Systems: Economic and Distributed Approaches

In view of the growing discussion around climate change, emission targets, and emission taxation, there is widespread scientific consensus about the need for decarbonization and defossilization of energy supply. These necessities are closely related with the demand for efficient management and operation of energy systems. The corresponding technological and scientific challenges cannot be mastered without progress on tailored methods for control and automation of sector-coupled energy systems, that is, systems comprising electricity and other forms of energy such as heat, cold, gas, and so on. Among the manifold advanced control methods at hand, model predictive control (MPC) stands out due to its proven applicability on industrial scale and due to its ability to effectively handle system constraints, forecast information, and performance criteria.

In this light, the present special issue collects 12 original research articles on MPC for energy systems, whereby special focus is put on economic and distributed approaches. The first group of articles in this special issue puts focus on method development. These articles investigate different aspects of economic and noneconomic MPC ranging from the use of barrier functions, performance, and stability results for time-varying settings via tracking in a stochastic formulation to distributed schemes relying on dual composition.[1-4]

The second group of articles considers the application of MPC to problems arising in electrical power systems such as multiperiod power flow problems, smart grids, and induction motors.[5-9]

Finally, the third group of articles discusses application-oriented settings, which share the common attribute of sector coupling, that is, they include elements of coupling different energy forms and the corresponding sectors.[10-12]

Naturally, this special issue merely provides a snapshot of the manifold and concurrent research activities on tailored predictive control methods for multienergy systems. Yet, it is also a strong indicator that economic and distributed MPC approaches will continue to play a pivotal role in the years to come.

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REFERENCES

1. Bitlislioglu A, Jones C. Regularized economic model predictive control with barrier functions. *Optim Control Appl Meth*. 2020;41(1):3-24.
2. Pannocchia, G. Razzanelli, M. Cristostomi, E. Pallottino, L. Distributed model predictive control for energy management in a network of microgrids using the dual decomposition method. *Optim Control Appl Meth*. 2020;41(1):25-41.
3. Pirkelmann, S. Grune, L. Economic model predictive control for time-varying system: performance and stability results. *Optim Control Appl Meth*. 2020;41(1):42-64.
4. D'Jorge, A. Santoro, B. Anderson, A. González, A. Ferramosca, A. Stochastic model predictive control for tracking linear systems. *Optim Control Appl Meth*. 2020;41(1):65-83.
5. Arahal, M.R.; Martin, C. Kowal, A., Castilla, M, Barrero, F. Cost function optimization for predictive control of a five-phase IM drive. *Optim Control Appl Meth*. 2020;41(1):84-93.
6. Velarde Rueda, P. Zafra-Cabeza, A. Maestre Torreblanca, J.M. Multicriteria optimal operation of a microgrid considering risk analysis, renewable resources, and model predictive control. *Optim Control Appl Meth*. 2020;41(1):94-106.

7. Faulwasser, T. Engelmann, A. Toward economic NMPC for multistage AC optimal power flow. *Optim Control Appl Meth*. 2020;41(1): 107-127.
8. Worthmann, K. Sauerteig, P. Towards multi-objective optimization and control of smart grids. *Optim Control Appl Meth*. 2020;41(1): 128-145.
9. Ananduta, W. Maestre Torreblanca, J.M. Ocampo-Martinez, C. Ishii, H. Resilient distributed model predictive control for energy management of interconnected microgrids. *Optim Control Appl Meth*. 2020;41(1):146-169.
10. Pannocchia, G. Razzanelli, M. Cristostomi, E. Pallottino, L. Distributed model predictive control strategies for coordination of electro-thermal devices in a cooperative energy management concept. *Optim Control Appl Meth*. 2020;41(1):170-189.
11. Mazaeda, R. Cristea, S. de Prada, C. Hierarchically-coordinated economic MPC plantwide control of mixed continuous-batch units in process industries with application to a beet sugar plant. *Optim Control Appl Meth*. 2020;41(1):190-214.
12. Bravo, J. Cojocaru, E. Vasallo, M. Marín, D. A binary-regularization-based model predictive control applied to generation scheduling in concentrating solar power plants. *Optim Control Appl Meth*. 2020;41(1):215-238.