Predictive Control in Renewable Energy Systems

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Abstract
Model predictive control (MPC), also called receding horizon control, is an online optimization control technique able to easily tackle system constraints and nonlinearity. This technique is based on a dynamic model to forecast system behaviour and uses a flexible cost function to produce the best control output. MPC has freedom to further improve the system control performance, since the "predicted behaviours" of the system are utilized within the control/decision process.

MPC is an important and advanced control technique in renewable energy systems, which can be implemented with modern microcontrollers and digital signal processors at a low cost, allowing them to solve the problems of difficult multivariable control. The use of predictive control offers a number of advantages, including a very intuitive approach, no need for modulators, and simple inclusion of nonlinearities and restrictions. MPC, an attractive alternative to linear control and modulation, is the current state-of-the-art research, as well as a popular subject for academic and industrial research.

The objective of this Special Session is to provide a timely opportunity for scientists, researchers, and practicing engineers to share and disseminate their latest discoveries and results in the area of MPC applications and associated challenges of MPC in renewable energy and high-power energy conversion. Prospective authors are invited to submit original contributions, survey papers, or tutorials for review for publication in this Special Issue.

Due to the existence of symmetry in certain engineering systems, the resulting optimization problem possesses some form of symmetry. For example, in some constrained optimization problems, certain variables appear symmetrically in objective and constraint functions. Therefore, we also encourage scholars in related fields to contribute papers that employ symmetry or asymmetry concepts in the predictive control of renewable energy and high-power energy conversion systems.

Topics of interest include but are not limited to:

- Predictive control for renewable energy and high-power energy conversion systems, e.g., photovoltaics, wind turbines, wave energy, utility-scale power electronics for the grid (FACTS, HVDC systems, UPS, etc.), energy storage, power quality conditioners;
- Industrial applications of MPC in high-power electronic systems, e.g., variable speed drive systems, electric vehicles, multilevel power converters;
- Data-driven (model-free) predictive control techniques in power electronic systems with a focus on industrial applications;
- Artificial intelligence in a predictive control frame in power conversion systems;
- (Advanced) predictive control for power systems, smart grids, and microgrids;
- Symmetry or asymmetry concepts in the predictive control of renewable energy and high-power energy conversion systems.