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Recent Advances, Future Trends and Challenges of Model Predictive Control applied to Power Electronics

Recently, the rapid advancement of modern microcontrollers has revolutionized power converter control, enabling the development and implementation of new intelligent control and modulation strategies. Among these, Model Predictive Control (MPC) has emerged as a powerful and versatile alternative, getting significant attention from both academia and industry. MPC offers numerous advantages over classical linear controllers, including its intuitive design, elimination of linear controllers and modulators, and seamless integration of nonlinearities and constraints into the control law. These features make MPC strategies a highly promising solution for tackling complex control challenges in various areas of power electronics. Therefore, this tutorial will address the latest advancements and trends in MPC for power converters, highlighting its practical benefits and potential for widespread industrial adoption. Participants will gain insights into the fundamental principles of MPC, explore state-of-the-art applications, and learn about emerging opportunities and challenges for optimizing system performance. The tutorial will provide a comprehensive understanding of how MPC is reshaping the future of power electronics and drives, bridging the gap between academic research and real-world implementation.