

Model Predictive Control of Power Converters and Electrical Drives

Abstract

In recent decades, advancements in modern microcontrollers have enabled the development of intelligent control strategies, offering alternatives to conventional techniques for power converters. Predictive control has gained significant attention due to its intuitive approach, eliminating the need for linear controllers and modulators. It also easily incorporates nonlinearities and constraints into the control law, enhancing flexibility and adaptability. These advantages position predictive control as a promising solution for future industrial applications, contingent on further advancements and refinements.

Special Session Topics

- Predictive control applied to power converters and actuators: AC/AC, DC/AC, AC/DC, DC/DC converters.
- Predictive control in variable speed drives.
- Design and implementation issues of predictive control: prediction horizon extension, improved sampled-data models, cost function selection, weighting factor design, delay compensation, model parameters errors, variable switching frequency, etc.
- Predictive control implementations with machine learning, artificial intelligence, and more cutting-edge technologies.
- Predictive control in industrial and non-industrial applications: railway traction, electrically powered vehicles, more electric aircraft, wind energy generation, photovoltaic energy generation, power quality conditioners, etc.
- Sensorless control of electrical machines.

Author Bios and Pics



Prof. Marco Rivera, Power Electronics, Machines and Control (PEMC) Research Institute, University of Nottingham, UK. Email: Marco.Rivera@nottingham.ac.uk. He received the Electronic Civil Engineering degree and the M.Sc. degree in Engineering, with specialization in Electrical Engineering, from the Universidad de Concepción. Later he obtained a PhD. degree in Electronic Engineering from the Universidad Técnica Federico Santa María, and was awarded the “Premio Tesis de Doctorado Academia Chilena de Ciencias 2012”, for the best PhD Thesis developed in 2011 for national and foreign students in any exact or natural sciences program, that is member of the Academia Chilena de Ciencias, Chile.

He is the Director of the Laboratory of Energy Conversion and Power Electronics (Laboratorio de Conversión de Energías y Electrónica de Potencia, LCEEP) at Universidad de Talca, Chile. He was a full professor at the Department of Electrical Engineering at the Universidad de Talca. Since April 2023 he joined the Power Electronics, Machines and Control (PEMC) Research Institute of the University of Nottingham as a Professor. His main research areas are power electronics, renewable energies, advanced control of power converters, microgrids, among others. He has published more than 550 academic publications in leading international conferences and journals.

Prof. José Rodríguez, Universidad San Sebastián, CHILE. Email: jose.rodriquezp@uss.cl. He received the Dr.-Ing. degree in electrical engineering from the University of Erlangen, Erlangen, Germany, in 1985. He has been a professor and President of Universities Federico



Santa María, Andrés Bello and San Sebastián in Chile. He has co-authored two books and more than 1000 journal and conference papers. Dr. Rodriguez is a member of the Chilean Academy of Engineering. In 2014 he received the National Award of Applied Sciences and Technology from the government of Chile. In years 2014 to 2023, he has been included in the list of Highly Cited Researchers published by Web of Science.

His main lines of research are multilevel inverters, new converter topologies, control of power converters, adjustable-speed drives, renewable energy and electromobility.



Prof. Patrick Wheeler, Power Electronics, Machines and Control (PEMC) Research Institute, University of Nottingham, UK. Email. Pat.Wheeler@nottingham.ac.uk. He received his BEng [Hons] degree in Electrical Engineering in 1990 from the University of Bristol, UK. He received his PhD degree for his work on Matrix Converters from the University of Bristol, UK in 1994. In 1993 he moved to the University of Nottingham and worked as a research assistant in the Department of Electrical and Electronic Engineering. In 1996 he became a Lecturer in the Power Electronics, Machines and Control Group at the University of Nottingham, UK. Since January 2008 he has been a Full Professor in the same research group.

He is currently the Director for Global Engagement in the Faculty of Engineering and the Head of the Power Electronics, Machines and Control Research Group. He was Head of the Department of Electrical and Electronic Engineering at the University of Nottingham from 2015 to 2018. He is a member of the IEEE PELs AdCom and is currently IEEE PELS Vice-President for Technical Operations. He has published over 950 academic publications in leading international conferences and journals.

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