EPE'25 – Call for Tutorials

(Template: Please make sure the proposal is no longer than 3 pages – Please delete THIS text in red)

MODEL PREDICTIVE CONTROL OF POWER CONVERTERS AND DRIVES

Name(s) and Affiliation(s) of the Lecturer(s):

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Tutorial Objectives:

In this paragraph, please describe the tutorial objectives of the tutorial that you propose. Please make sure the objectives are clearly described.

In the last decades, the application of fast modern microcontrollers has been continuously growing, allowing the development and implementation of new and more intelligent control strategies as an alternative to conventional techniques for power converters. Model Predictive Control is one of these powerful and attractive alternatives that has received a lot of attention in recent years. The use of predictive control offers several interesting advantages: it is an intuitive control approach, it does not need linear controllers and modulators, and it is possible to easily include nonlinearities and restrictions in the control law. It is expected that the advantages of predictive control will lead to industrial applications very shortly. In this tutorial, new advances and trends in the application of model predictive control for power electronics and electrical drives will be presented.

Target Audience:

In this paragraph, please describe the target audience of the tutorial that you propose. Please make sure the target audience is clearly described.

The target audience are academics, researchers, students and people from industry interested in to know the basic principles and more advances aspects of model predictive control in different power converters and electrical drives.

Topical Outline:

Introduction - (Estimated time: 15 minutes)

- Introduction to Model Predictive Control
- Principles and operation
- Cost functions and weighting factors
- Implementation examples

Examples of Predictive Control in Power Converters and Drives – (Estimated time: 30 minutes)

- Example 1, MPC applied to a two-level inverter
- Example 2, MPC applied to a three-level inverter
- Example 3, MPC applied to a matrix converter
- Example 4, MPC applied to an induction machine
- Example 5, MPC applied to a multidrive system

Technical Issues for the Implementation of Predictive Control – (Estimated time: 90 minutes)

- Theme 1, Selection of cost functions
- Theme 2, Design of weighting factors
- Theme 3, Delay compensation
- Theme 4, Effect of errors in model parameters

Trends and Challenges of Predictive Control - (Estimated time: 30 minutes)

- Challenges of model predictive control implementations
- Trends for the implementation of model predictive control
- Conclusion 1

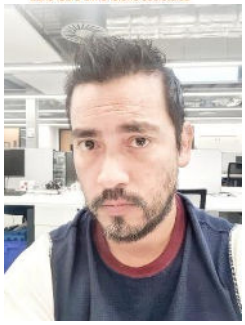
Provisional Schedule of the Tutorial:

Schedule:

14:00 – 15:30: Introduction / Theme 1 / Theme 2
15:30 – 16:00: Coffee break / Lunch Break
16:00 – 17:30: Theme 3 / Theme 4 / Conclusions

About the Lecturers:

Marco Rivera received the PhD. degree in Electronic Engineering from the Universidad Técnica Federico Santa María, Chile and was awarded with 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 full professor at the Department of Electrical Engineering from the Universidad de Nottingham and his main research areas are power electronics, advanced control of power converters, among others. He has published over 500 academic publications in leading international conferences and journals.

Patrick Wheeler received his BEng [Hons] degree in 1990 from the University of Bristol, UK. He received his PhD degree in Electrical Engineering 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 was Head of the Department of Electrical and Electronic Engineering at the University of Nottingham from 2015 to 2018. He is currently the Head of the Power Electronics, Machines and Control Research Group, Global Director of the University of Nottingham's Institute of Aerosapce Technology and was the Li Dak Sum Chair Professor in Electrical and Aerospace Engineering. He is a member of the IEEE PELs AdCom and is currently IEEE PELS Vice-President for Technical Operations. He has published over 750 academic publications in leading international conferences and journals.

Javier Muñoz was born in Concepción, Chile, in 1983. He received the B.S. (with first-class honors), M.Sc., and D.Sc. degrees in electrical engineering from the University of Concepcion, Concepcion, Chile, in 2007, 2009, and 2012, respectively.,Since April 2011, he has been with the Department of Industrial Technologies, University of Talca, Curicó, Chile, where he is currently teaching in the areas of dynamic systems and robotics. His research interests include digital control of modular multilevel converters to improve power quality.