

EEECIS/IAS/IEEE SEMINAR

“Model Predictive Control in Power Electronics”

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G31, Emerson Electric Co. Hall, Missouri University of Science and Technology, Rolla

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In the context of control, hybrid systems combine continuous and discrete dynamics. Model Predictive Control (MPC) is a technique where the control objective is expressed as a constrained optimization problem. The cost function is evaluated over a receding horizon and based on the evolution of the system that is evaluated through a discrete model. Model Predictive Control is very well suited to solve hybrid control problems that include constraints. Power converters are typical hybrid systems. Their behavior is continuous between the switches' commutation and displays discrete abrupt changes following each commutation. Application of MPC in power electronics started recently, as in most cases the optimization process requires intensive computations that are/were not compatible with the very short sampling time of power electronic systems. Explicit model predictive control has been one of the main enabling factor for the technique expansion to power electronics. It is applicable for a large number of problems and requires a very limited computational power. The optimization problem is solved off-line, the on-line task only amounts to obtain the control input through a look-up table. The talk will present some aspects of Model Predictive Control through some selected power electronics applications.

Dr. Sébastien Mariethoz received the B.S. in telecommunication in 1993 in EIG Geneva (Switzerland), M.S. in electrical engineering and Ph.D. in Power Electronics in 1999 and 2005 at EPFL Lausanne (Switzerland). From 1999 to 2005, he has been a research and teaching assistant with the Industrial Electronics Laboratory of EPFL Lausanne (Switzerland), where his main research topics have been Multilevel Inverters and Active Power Filters. From 2005 to 2006, he has been a research fellow with the PEMC group of the University of Nottingham (UK), where his main research topic were matrix converters and hybrid power converter topologies based on matrix converters. He joined the Automatic Control Laboratory of ETH Zürich (Switzerland) in 2006, and his main research area is the control of power converters and drives, with special emphasis on Model Predictive Control and Kalman filter techniques.