TUTORIAL 2

"Magnetic and Thermal Self-Commissioning Techniques for AC Motor Drives and Inverters"

SPEAKER

Paolo Pescetto

Politecnico di Torino

SPEAKER

Shafiq Odhano

Newcastle University

SPEAKER

Marko Hinkkanen

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Luca Peretti

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Accurate identification of motor drive parameters, including machine and converter characteristics, is essential in various applications. Precise measurement of these parameters is critical for validating machine design procedures and implementing model-based control schemes. Among these parameters, measuring flux saturation curves is especially crucial, as it significantly impacts drive performance. Additionally, understanding the operating limits of the drive necessitates thermal characterization, which plays a key role in optimizing efficiency and performance. Moreover, voltage source inverters introduce non-linear distortion of the phase voltage, which can impair control accuracy and limit performance, particularly in low-speed or sensorless applications.

 While precise drive characterization can be achieved in a controlled laboratory environment, it is often impractical in industrial settings. This is due to the lack of dedicated testing facilities, the high variability caused by manufacturing tolerances, and time constraints on production lines. In such cases, a self-commissioning approach is commonly employed, where motor drive parameters are determined through fast, automatic tests. These tests are conducted with the drive directly mounted in its target application, without requiring additional measurement hardware beyond the drive itself. While self-commissioning tests provide lower accuracy compared to laboratory characterizations, they offer sufficient precision for calibrating motor control algorithms, even in sensorless applications.

This tutorial explores the state of the art in self-commissioning procedures for both synchronous and asynchronous motor drives, addressing both motor and converter characteristics. Special attention will be given to evaluating saturation characteristics and thermal parameters, as well as methods for compensating for non-linear voltage drops in the converter.

IEMDC 2025

International Electric Machines & Drives Conference
Houston, TX May 18 - 21, 2025

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BIOS

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Paolo Pescetto is an Assistant Professor at Politecnico di Torino, Italy. He received the M.Sc. and PhD degrees with full grades and honors from Politecnico di Torino, Turin, Italy, in 2015 and 2019. Since fall2019, he has been working as a researcher and tenure-track lecturer in the Energy Department of Politecnico di Torino. He is a member of the Power Electronics Innovation Center (PEIC) of Politecnicodi Torino. He authored or co-authored 40+ scientific works, with 14 IEEE journal papers. Since fall 2022he has been the vice chair of the IEEE IA/IE/PEL North Italy Joint Chapter. His main research interests include synchronous motor drives, sensorless control, self-commissioning techniques, and integrated battery chargers for EVs. Dr. Pescetto received five IEEE paper Awards and two IEEE PhD thesis awards.

Shafiq Odhano is with Newcastle University, Newcastle upon Tyne, United Kingdom, where he is a lecturer in electric drives. He obtained his MSc and PhD degrees from Politecnico di Torino, Italy. He was previously affiliated with the Politecnico di Torino (Italy) and the University of Nottingham (United Kingdom) as a research fellow. His research interests include parameter identification for high-performance control of electric drives, fault-tolerant control of multiphase machines and drives, position sensorless control of synchronous motor drives and direct power control of doubly fed induction generators.

Marko Hinkkanen (IEEE Fellow) received the M.Sc.(Eng.) and D.Sc.(Tech.) degrees in electrical engineering from the Helsinki University of Technology, Espoo, Finland, in 2000 and 2004, respectively. He is currently an Associate Professor (tenured) with the School of Electrical Engineering, Aalto University, Espoo, Finland. His research interests include control systems, electric machine drives, and power converters. Dr. Hinkkanen was the co-recipient of eight paper awards and of the 2020 SEMIKRON Innovation Award. He was the General co-chair of the 2018 IEEE 9th International Symposium on Sensorless Control for Electrical Drives (SLED). He is an Associate Editor of IEEE Transactions on Energy Conversion and the IET Electric Power Applications.

Luca Peretti (IEEE Senior Member) received the M. Sc. degree in Electronic Engineering in 2005 from the University of Udine, Italy, and the Ph.D. degree from the University of Padova, Italy, in 2009. From August 2010 to August 2018, he was with ABB Corporate Research, Västerås, Sweden in different roles as principal scientist, project leader and strategy coordinator. He has also been an Affiliated Faculty member at KTH, division of Electric Power and Energy Systems, since July 1, 2016. Since September 2018 Luca is an Associate Professor at KTH, division of Electric Power and Energy Systems, in the field of Electric Machines and Drives. His main scientific interests relate to the automatic parameter estimation in electric machines, sensorless control, loss segregation in drive systems, multiphase drives, condition monitoring of machines and drives, in the context of industrial, wind energy, and traction applications.

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