



EPE'22 ECCE Europe – Tutorial Announcement

Emerging and Selected Topics in PMSM Drives

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

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Scope and Benefits:

Permanent magnet synchronous machine (PMSM) has been applied in the wide spectrum of industry including but not limited to renewable energy, transportation, military, and medical systems, thanks to the advantages of high power density and high efficiency. Recently, large effects have been devoted towards the high-performance PMSM drives. Three emerging and selected topics in PMSM drives, including sensorless control, electrolytic capacitorless control and parameter identification, are to be presented in this tutorial. This tutorial is available for specialists in power electronics and AC motor drives. The tutorial aims to introduce the technical knowledge from both academia and industry perspectives.

Contents:

Introduction and Overview

- Basic structure and modeling of PMSM
- Space vector control-based PMSM drive
- Emerging and selected topics in PMSM drives

Real Tutorial, Theme 1: Acoustic noise reduction using pseudorandom (PR) signal injection for sensorless PMSM drives

- Basic principle and implementation of PR signal injection
- PR frequency injection based sensorless control
- PR phase injection based sensorless control
- Hybrid PR injection based sensorless control

Real Tutorial, Theme 2: Harmonic regulation for electrolytic capacitorless PMSM drives

- Modelling of electrolytic capacitorless drives
- System impedance reshaping for inherent harmonics
- Best suppression based on voltage reconstruction



Real Tutorial, Theme 3: Parameter identification of PMSM drives

- Offline parameter identification method
- Online parameter identification method
- Nonideal error compensation of parameter identification

Conclusions

- Future trends of sensorless PMSM drives in industrial and domestic applications
- Future trends of electrolytic capacitorless PMSM drives in industrial and domestic applications
- Future trends of parameter identification for PMSM drives

Schedule:

13:00 - 14:00	Lunch break (Optional – If ordered)
14:00 – 15:30	Tutorials Afternoon – Part 3
15:30 – 16:00	Coffee break
16:00 – 17:30	Tutorials Afternoon – Part 4

Who should attend:

This tutorial is available for beginners and specialists in power electronics and AC motor drives. The tutorial aims to introduce the technical knowledge from both academia and industry perspectives. By the end of this tutorial, audiences would benefit from three typical topics in PMSM drives, including sensorless control, electrolytic capacitorless control and parameter identification.

Technical Level:

Technical Level: Beginners, advanced, etc.

About the Lecturers:

Provide a short CV of the lecturers including a photograph.



Gaolin Wang (Senior Member, IEEE) received the B.S., M.S., and Ph.D. degrees in electrical engineering from the Harbin Institute of Technology, in 2002, 2004, and 2008, respectively. In 2009, he joined the School of Electrical Engineering and Automation, Harbin Institute of Technology as a Lecturer, where he has been a Full Professor of electrical engineering since 2014. From 2009 to 2012, he was a Postdoctoral Fellow in Shanghai Step Electric Corporation, where he was involved in the traction machine control for direct-drive elevators. His current major research interests



include permanent magnet synchronous motor drives, high performance direct-drive for traction system, position sensorless control of AC motors, efficiency optimization control of PMSM, and digital control of power converters. Prof. Wang has been awarded The National Science Fund for Distinguished Young Scholars, Newton Advanced Fellowship, and Delta Young Scholar Award. He has won 4 provincial and ministerial level scientific and technological achievements, and more than 10 Best Paper Awards. Prof. Wang serves as a Guest Associate Editor of IEEE Transactions on Industrial Electronics, an Associate Editor of IEEE Transactions on Transportation Electrification, IET Electric Power Applications. He has given keynote speeches, tutorials, and invited seminars at EPE, ITEC-AP and other international conferences. Prof. Wang has authored more than 100 technical papers published in journals and conference proceedings. He is the holder of 30 Chinese patents. He served as Co-Chair of National Steering Committee of IPEMC2020-ECCE Asia, Co-Chair of Tutorial & Special Session Committee of ITEC Asia-Pacific 2017, Publicity Co-Chair of IEEE SDEMPED 2021, Organizing Committee Member of IEEE PRECEDE 2021, Track Chair of IEEE IECON 2016, TPC Committee Member, IEEE SLED 2023, CIEEC2022, ICEMS 2022, CIEEC2021, ICEMS 2021, PEDG 2019, ICEMS 2019, IPEMC 2016-ECCE Asia, and IEEE IPEC-Hiroshima 2014.



Guoqiang Zhang (Senior Member, IEEE) received the B.S. degree in Electrical Engineering from Harbin Engineering University, in 2011, and the M.S. and Ph.D. degrees in Electrical Engineering from Harbin Institute of Technology, in 2013 and 2017, respectively. Since 2017, he has been in the School of Electrical Engineering and Automation, Harbin Institute of Technology, where he is currently an Associate Professor. His current research interests include control of electrical drives, and parameter identification technique, with main focus on sensorless field-oriented control of synchronous motor drives. Dr. Zhang has won 3 provincial and ministerial level scientific and technological awards, including 1st Prize Award for Natural Sciences of Heilongjiang Province, 1st Prize Award for Technology Progress of Heilongjiang Province, and 2nd Prize Award for Technology Progress of MOE. He has won the Best Paper Award of Association for Science and Technology, China and several Best Paper Awards of international conferences. Dr. Zhang was selected as the fellowship of China National Postdoctoral Program for Innovative Talents and the fellowship of Postdoctoral Program for Youth Talents in Heilongjiang. Dr. Zhang actively participates in academic activities of the IEEE. He serves as an Associate Editor for Journal of Power Electronics, the technical committee member of IEEE International PCIM Asia Conference, Special Session Chair of ICEMS 2021. He also participated in holding ICEMS 2019 and ITEC Asia-Pacific 2017. Dr. Zhang gave an invited seminar at CPSSC'2017, Shanghai and a tutorial at EACS'2021, Hefei. He has authored 3 books and more than 40 papers published on IEEE Transactions.



Dawei Ding (IEEE Member) received the B.S and M.S degrees in Electrical Engineering from Hefei University of Technology, in 2014 and 2017, respectively, and the Ph.D degree in Electrical Engineering from Harbin Institute of Technology (HIT), in 2021. Currently, he is an Assistant Professor in School of Electrical Engineering and Automation, HIT. From 2020 to 2021, he was a visiting Ph.D in Technical University of Denmark. He has authored more than 10 journal papers in IEEE Transactions and held 9 authorized Chinese invention patents. His current research interests include advanced control of permanent magnet synchronous motor drives and electrolytic capacitorless AC motor drives. Dr. Ding is a member of IEEE, and serves as Special Session Chair of ICEMS 2022. He has given oral presentations in the 10th International Conference on Power Electronics 2019 -ECCE Asia, 2019 CPSSC, and 2019 National Doctoral Forum on Electrical Engineering. He has been awarded the National Scholarship for Postgraduates, the INOVANCE Outstanding Scholarship, and the Outstanding Graduate in HIT.



Qiwei Wang (IEEE Member) received the B.S., M.S. and Ph.D. degrees in Electrical Engineering from Harbin Institute of Technology, in 2015, 2017 and 2022, respectively. He received the Mechanical Engineer degree in Troyes University of Technology, Troyes, France, in 2018. He is currently working toward the Postdoc in power electronics and electrical drives in the School of Electrical Engineering and Automation, Harbin Institute of Technology. He has authored more than 10 journal papers in IEEE Transactions and applied for more than 10 Chinese invention patents. His current major research interests include permanent magnet synchronous motor drives, position sensorless control of AC motors, parameter identification technique. Dr. Wang is a member of IEEE, and serves as Special Session Co-Chair of ICEMS 2022. He has been awarded the Outstanding Graduate in HIT.