



EPE'23 ECCE Europe – Call for Tutorials

Fundamentals and Advancements of Modern High-frequency Magnetic Components

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.

All power electronic converters need magnetic components. With the widely use of wide-bandgap power electronic components, the design and analysis concept of integrating magnetic components into power electronic converters are challenges. In this proposal, we aim to introduce both fundamental and advancements of magnetic components, where we wish to introduce basic analysis tools and solutions for designing magnetic components. The challenges, opportunities and trends for magnetic components will be involved in this 3-hour tutorial.

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.

Both engineers and researchers in the field of power electronics will benefit from the tutorial. We will show the historical research of magnetic components, where the unique challenges of integrating modern magnetic components into wide-bandgap power components will be addressed.



Topical Outline:

Introduction: (Estimated time: 10 minutes) By Prof. Gerard Hurley.

- Introduction to magnetic components.

Overview on Magnetic components: (Estimated time: 10 minutes) By Prof. Gerard Hurley.

- History of magnetic components.

Real Tutorial 1: Challenges, opportunities and trends for magnetic components: (Estimated time: 40 minutes) By Prof. Gerard Hurley.

- Magnetics Material
- Research and Design challenges

Real Tutorial 2, Shielding and Reliability of Magnetic components (Estimated time: 30 minutes) By Prof. Zhan Shen

- EMI Model of Transformers with Faraday Shield
- Faraday Shield Loss Modeling and Design
- Reliability Issues in High Frequency Transformers
- Accelerated Aging Test, Result Analysis, and Lifetime Prediction of High Frequency Transformers

Real Tutorial 3, Modern Planar Magnetic Components (Estimated time: 50 minutes) By Prof. Ziwei Ouyang

- Structure of planar magnetic components
- Reducing Leakage Inductance and ac Resistance in Planar Magnetics
- Impacts of Magnetic Fringing Field
- Integrated Magnetic Components

Real Tutorial 4, Parasitic Capacitance in Magnetic Components (Estimated time: 30 minutes) By Dr. Hongbo Zhao

- Principle of Parasitic Capacitance
- Modeling Methods for Parasitic Capacitance
- Methods for Reducing Parasitic Capacitance

Conclusions (Estimated time: 10 minutes) By Prof. Gerard Hurley and Prof. Ziwei Ouyang

- Trends and Opportunities
- Wrap up

Provisional Schedule of the Tutorial:

Schedule:

9:00 – 10:30: Introduction / Overview / Real Tutorial 1/ Real Tutorial 2

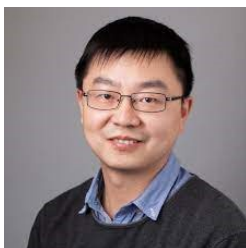
10:30 - 10:40 : Coffee break

10:40 - 12:10 : Real Tutorial 3 / Real Tutorial 4 / Conclusions

About the Lecturers:



William Gerard Hurley (Life Fellow, IEEE) received the B.E. degree in electrical engineering from the National University of Ireland, Cork, in 1974, the M.S. degree from the Massachusetts Institute of Technology, Cambridge, MA, USA, in 1976, the Ph.D. degree from the National University of Ireland, Galway, in 1988, and the D.Eng. degree based on his publications in 2010. He was with Honeywell Controls, Canada, from 1977 to 1979 and Ontario Hydro from 1979 to 1983. He was a Lecturer with the University of Limerick, Ireland, from 1983 to 1991. He is currently an Emeritus Professor of electrical engineering with the University of Galway. He served on the faculty with the Massachusetts Institute of Technology as a Visiting Professor from 1997 to 1998. He was a Visiting Professor with the Tianjin University of Technology in 2016. He has coauthored a text book on transformer and inductors that has been translated into Chinese. Research interests include high-frequency magnetics, wireless power, and renewable energy systems. Dr. Hurley was a recipient of the 2013 IEEE PELS Middlebrook Award for Technical Achievement. He was the General Chair of the Power Electronics Specialists Conference in 2000. He was appointed as a Distinguished Lecturer of the IEEE from 2014 to 2017.



Ziwei Ouyang (Senior Member, IEEE) received the Ph.D. degree in power electronics from Technical University of Denmark (DTU), Kongens Lyngby, Denmark, in 2011. Since from April 2016, he has been an Associate Professor with DTU. He has more than 100 high impact IEEE journal and conference publications, and 9 international patents. His research interests include switch mode power supply, magnetics modeling and integration, energy storage system, and wireless charging. Prof. Ouyang was the recipient of 2022 IEEE Transactions on Power Electronics First Place Prize Paper Award, and several Best Paper Awards in IEEE sponsored international conferences.



Zhan Shen (Member, IEEE) received the B.E. degree in electrical engineering and automation from Nanjing University of Aeronautics and Astronautics in 2013 and M.E. degree in electrical engineering from Southeast University in 2016, both in Nanjing, China, and Ph.D. degree in energy technology from Aalborg University, Aalborg, Denmark in 2020. He conducts his research as a Postdoc researcher in Aalborg until 2021 and as an Associate Professor at Southeast University in Nanjing. He was a Visiting Student and pursued his master thesis at the RWTH Aachen University, Aachen, Germany, from Oct. 2014 to Feb. 2016, and a Visiting Scholar with the Massachusetts Institute of Technology (MIT), Cambridge, MA, USA, from Oct. 2018 to Jan. 2019. He was with the ABB Corporate Research Center, Beijing, China, in 2016. His research interests include the electromagnetic-thermal-reliability modeling and design of magnetic components in power electronic converters, and EMI. Prof. Shen was the recipient of multiple Best Paper and Best Presenter Awards of the IEEE PELS sponsored conferences.



Hongbo Zhao (Member, IEEE) received the Ph.D. degree in Power Electronics from Aalborg University, Denmark in 2021. From Jan. 2021-Apr. 2021, he was a visiting student in the University of Texas at Austin. From Jan. 2023- Apr. 2023, he was a visiting scholar in the University of Galway. Currently, he is a Postdoc Researcher with Aalborg University, Aalborg, Denmark. His research interests include high-frequency modeling and analysis of high-power magnetics and filters, as well as medium-voltage converters enabled by wide band-gap power devices. He is a recipient of 2022 Villum Experiment grant.