



## **TITLE**

Optimal Design of Inductive Power Components based on Accurate Loss and Thermal Models

## **NAME AND AFFILIATION OF THE AUTHORS**

Dr. Jonas Mühlethaler  
Gecko-Simulations AG  
Zurich, Switzerland

## **SCOPE AND BENEFITS**

After the presentation, the audience should have an increased understanding of how magnetic components are being modelled. Furthermore, with the introduced steps, the participant of the tutorial should be able to optimally design inductive power components.

## **CONTENTS**

In the first part of the presentation, loss and thermal models of inductive components are presented in detail. The impact of the flux density, frequency, DC premagnetization, temperature, core shape, minor and major loops, flux waveform, and material on the core loss calculation are discussed. In order to calculate winding losses, formulas for round conductors and litz wires, each considering skin- and proximity effects (including the influence of an air-gap fringing field) are shown. The modelling part is concluded with a discussion about how to thermally model inductive components. A high level of accuracy is achieved by combining the best state-of-the-art loss and thermal models with newly-developed models. These loss and thermal models will further form the basis for the design of inductive components. Therefore, the focus of the second part of the presentation will be placed on how to optimally design inductive components of power electronic applications. All required formulas and all performed steps are presented such that a tutorial presentation arises.

The schedule is as follows:

### **Monday, September 2<sup>nd</sup> - Tutorial day (Location: University of Lille)**

13:30 - 14:00	Registration for <b>Tutorials</b>
14:00 - 15:30	Tutorials Part 1
15:30 - 16:00	Coffee break
16:00 - 17:30	Tutorials Part 2

17:00 - 19:00      Possibility for registration for the EPE2013 ECCE Europe in the lobby of Lille Grand Palais

## **WHO SHOULD ATTEND**

Engineers, researchers, or managers that are interested in gaining knowledge about the design of magnetic components should attend this tutorial.



**Technical Level:**

The topic will be treated in-depth and the level of the intended audience is intermediate.

**ABOUT THE INSTRUCTORS**



Jonas Mühlethaler received his M.Sc. in 2008 and the Ph.D. degree in 2012, both in electrical engineering and both from the Swiss Federal Institute of Technology Zurich (ETHZ), Switzerland. In 2008 he joined the Power Electronic Systems Laboratory (PES), ETHZ, to work towards his Ph.D. degree. During the Ph.D. studies, which he finished in 2012, he worked on modeling and multi-objective optimization of inductive power components. He is a co-founder of the Gecko-Simulations AG, a company that makes simulation tools for power electronics engineers. Dr. Mühlethaler is the author of 19 conference and Transaction papers and a Member of the IEEE. He held several seminar/tutorial/workshop presentations.