

Tutorial Proposal

1. Tutorial Title

Insight in Modern Capacitor Technologies for Power Electronic Applications

2. Instructor Team: name(s), affiliation(s), and contact information

Thomas Ebel, Prof. Dr.

Centre for Industrial Electronics, University of Southern Denmark

3. Abstract (No more than 500 words. Accepted abstract will be published through the conference website, program, and proceedings.)

Capacitors are one of the fundamental components in electronics. Nowadays the increasing power density and new semiconductor power devices like SiC or GaN are requiring new capacitors and designs.

This PEDG 2022 capacitor tutorial will introduction into different capacitor technologies like Aluminium Electrolytic Capacitors (Wet, Polymer, Hybrid); Metallized Film Capacitors (inc. Power Capacitors), Ceramic Capacitors and Supercapacitors with a focus:

- Physics of capacitors
- Properties of different capacitor technologies
- Materials of capacitors
- Applications of capacitors in power electronics with dedicated design in examples
- Discussion of reliability and lifetime models
- Discussion of examples

4. Tutorial Outline (Outline shall only define the topics and subtopics. No detailed descriptions please. Time allocation and instructor breakdown by topics is recommended.)

Lecture about capacitors

- **Introduction** (Estimated Time 5minutes)
- **Theme 1 _ General Physics of capacitors** (Estimated Time 10 minutes)
- **Theme 2 _ Properties of different capacitor technologies** (Estimated Time 15 minutes)
- **Theme 3 _ Materials of capacitors** (Estimated Time 45 minutes)
- **Theme 4 _ Applications of capacitors in power electronics with dedicated design in examples** (Estimated Time 30 minutes)
- **Theme 5 _ Discussion of reliability and lifetime models** (Estimated Time 30 minutes)
- **Theme 6 _ Discussion of examples / Conclulsion** (Estimated Time 40 minutes)

Schedule:

08:30-09:45: Introduction/Theme 1-3

09:45-10:00: Coffee break

10:00-11:40 Theme 4 - 6/ Conclusions

5. Lecture Style and Requirements (Briefly describe the tutorial format, which may include traditional lecture, software/hardware demonstration, interactive audience polls/quizzes, worksheets, discussion, etc. Note any equipment or space requirements beyond a laptop and projector. Also list the targeted audience and tutorial difficulty level, including any pre-requisite knowledge.)

Traditional lecture and discussion

6. Instructor Biography (No more than 200 words for each person. Each biography shall include the qualifications most relevant to the proposal. Past tutorial/teaching experience and outcome can be highlighted. External website link can be included but may not be reviewed.)

Prof. Dr. Thomas Ebel

Professional and scientific career

Since January 2022 **Full Professor, Head of the Section** Electrical Engineering (Campus Sønderborg and Odense) and Head of Centre for Industrial Electronics (CIE) in Sønderborg at the Department of Mechanical and Electrical Engineering at the Technical Faculty of the **University of Southern Denmark (SDU)**.

August 2018 – December 2021 Associate Professor, Head of the Section Electrical Engineering (Campus Sønderborg and Odense) and Head of Centre for Industrial Electronics (CIE) in Sønderborg of the **University of Southern Denmark (SDU)**.

September 2008 to July 2018 **Managing director** and shareholder before for a short time R&D Director at **FTCAP GmbH, Husum** Manufacturer of Aluminum Electrolytic and Film- Capacitors

October 2001-July 2008 **R&D Director, later Technical Director (CTO)**, Member of board of directors Becromal Norway at **Becromal S.p.A**, since 10/2008 **Epcos/TDK**, Milano, Italy

Manufacturer of foils for Aluminum-Electrolytic- Capacitors with former production sites in Norway, Island and USA



August 1995-September 2001 **R&D Engineer later R&D Director Siemens Matsushita Components**, Siemens AG PR, since 10/1999 **EPCOS** AG, since 10/2008 **TDK**, Business unit capacitors, Aluminum- Electrolytic- Capacitors, Heidenheim, Germany

October 1987-June 1995 **Westfälische Wilhelms-University of Münster**, Germany
Dr. rer. nat. at Prof. Wolfgang Jeitschko in Solid state Chemistry

Several Tutorials have been conducted at ECPE, IEEE CPE, PSMA, APEC and PCIM