

Organisational Information

Sign up at: www.ecpe.org/events

Registration Deadline:

6 December 2023

Participation Fee:

- € 670,- * for industry
- € 520,- * for universities/institutes
- € 180,- * for students/PhD students
(limited spaces; copy of students ID required; dinner € 50,-* extra)

* plus VAT

- The regular participation fee includes dinner, lunches, coffee/soft drinks. The reduced (PhD) students fee includes all the above except for dinner (can be booked for an extra fee of € 50,-*).
- The presentations will be provided by email via a download link short before the event. A printed version of the handout is available on request (€ 50,-*).
- Upon receipt of registration confirmation via email you are signed-up for the event. The invoice will be sent via email.
- 25 % discount for participants from ECPE member companies.
- 10 % discount for participants from ECPE competence centres.
- Further information (hotel list and maps) will be provided after registration and can be found on the ECPE web page.
- Cancellation policy: Full amount will be refunded in case of cancellation up to 2 weeks prior to the event. After this date 50 % of the fee is non-refundable (substitutes are accepted anytime).
- The number of participants is limited to 30 attendees.

Organisational Information

Organiser ECPE e.V.
Ostendstrasse 181
90482 Nuremberg, Germany
www.ecpe.org

Course Instructors Dr. Olaf Wittler, Fraunhofer IZM
Prof. Francesco Iannuzzo,
Aalborg University
Prof. Huai Wang, Aalborg University

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Venue Holiday Inn Eindhoven
Veldmaarschalk Montgomerylaan 1
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<https://www.ihg.com/holidayinn>



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Source frontpage: Fraunhofer IZM;

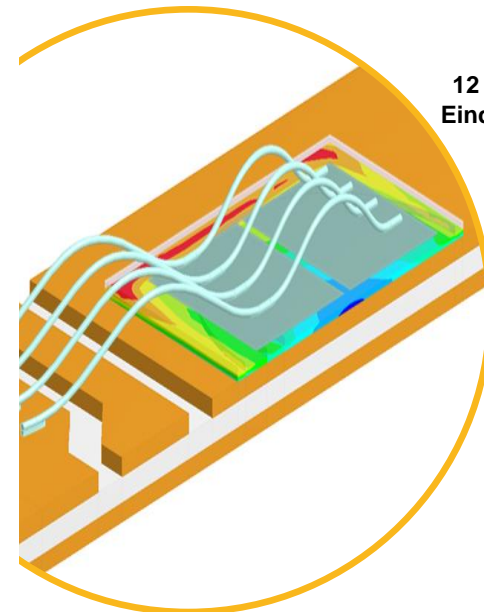


European Center for
Power Electronics e.V.

ECPE Tutorial

Reliability of Power Electronics - Part 1: Fundamentals and Converter Reliability

12 – 13 December 2023
Eindhoven, Netherlands



Reliability of Power Electronics - Part 1: Fundamentals and Converter Reliability

12 – 13 December 2023
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Electrifying the world is one of the pragmatic solutions for reducing carbon footprint. Electric transportation, renewable energy generation, electric storage, smart and micro grid technologies, as well as digitalization are essential parts of sustainable electricity systems. These technologies are supported by power electronics as the core of their energy conversion process. The overall performance of modern energy systems relies on the reliable operation of power electronics which needs accurate and optimized design, planning and control of power converters.

This tutorial is divided into two parts: The part “Reliability in Power Electronics Converters” introduces fundamentals of reliability terminology and failure mechanisms. Statistical aspects of reliability will be introduced, both theoretical and with a practical example. The “mission profile” incorporates the combination of loads and their duration to which the electronic system will be subjected. They determine depending on the construction (design) the physical processes and thus the life-time of the system. Most common test standards will be introduced and procedures on how to plan reliability tests are shown.

Further on, typical failure mechanisms which can occur within power electronic converters are discussed. This ranges from the power devices itself to assembly aspects like chip interconnects and material fatigue in potting materials, PCBs and adhesives.

As an outlook and preparation for part two, basic concepts of risk assessment techniques are presented, which can be applied on process and technology as well as converter and system level.

This tutorial covers comprehensive concepts of reliability modelling, analysis and enhancement in power electronic converters. Therefore, it would be fruitful for graduate students and senior researchers both from industry and academia who are interested in converter design, reliability modelling and enhancement in Power electronics systems.

All presentations and discussions will be in English.

Programme

Tuesday, 12 December 2023

08:30 Start of Registration

09:00 Welcome
Gudrun Feix, ECPE e.V.

09:10 Fundamentals of Power Electronics Reliability*
- Definition of reliability
- Quantification terms of reliability
- Categories
- Typical origins of failure
- Overview on failure mechanisms and models
Olaf Wittler

11:10 Coffee Break

11:30 Statistical Aspects of Reliability – Theory
- Basic statistical terms
- Distribution functions (Exponential, Weibull,...)
- Statistical handbooks and concepts (MTTF, MTBF,...)
- FTA, ETA, Block diagrams
Olaf Wittler

12:35 Lunch

13:30 Statistical Aspects of Reliability – Practical Part
Olaf Wittler

14:30 Functional Requirements and Test Planning
- Mission profiles
- Test standards (AQG 324, AEC Q101,...)
- Multiple Stresses
- Accelerated test planning
Olaf Wittler

15:30 Coffee Break

15:50 Functional Requirements and Test Planning II
Olaf Wittler

16:50 Reliability Assessment of Power Electronic Systems
Francesco Iannuzzo

17:20 Failure Mechanisms and Models
- Device Reliability (Si, SiC and GaN)
Francesco Iannuzzo

18:05 End of 1st Day

19:30 Dinner

*5 – 10 minutes break during long sessions

Programme

Wednesday, 13 December 2023

08:30 Start of 2nd Day

08:30 Failure Mechanisms and Models *
- Interconnects (Wire bond and die attach)
- Polymers (EMC, adhesive, PCB)
Olaf Wittler

09:45 Failure Mechanisms and Models *
- Passive components
- Higher order models for modules (LESIT, CIPS)
Huai Wang

11:00 Coffee Break

11:30 Introduction to Basic Concepts of Risk Assessment Techniques - Process and Technologies
- FMEA Approach
- FMEA Terms and Scales
- FMEA Evaluation of an example
- functional analysis
- Ishikawa-diagrams
Olaf Wittler

12:30 Lunch

13:30 Introduction to Basic Concepts of Risk Assessment Techniques - Converter and System Level
Huai Wang

14:30 Coffee Break – extra break

14:50 Reliability Simulation Techniques – Case Studies *
Olaf Wittler

16:20 Wrap up 2nd Day, Final Discussion, Feedback

16:30 End of Tutorial

Course instructors:

Dr. Olaf Wittler, Fraunhofer IZM (DE)

Prof. Francesco Iannuzzo, Aalborg University (DK)

Prof. Huai Wang, Aalborg University (DK)