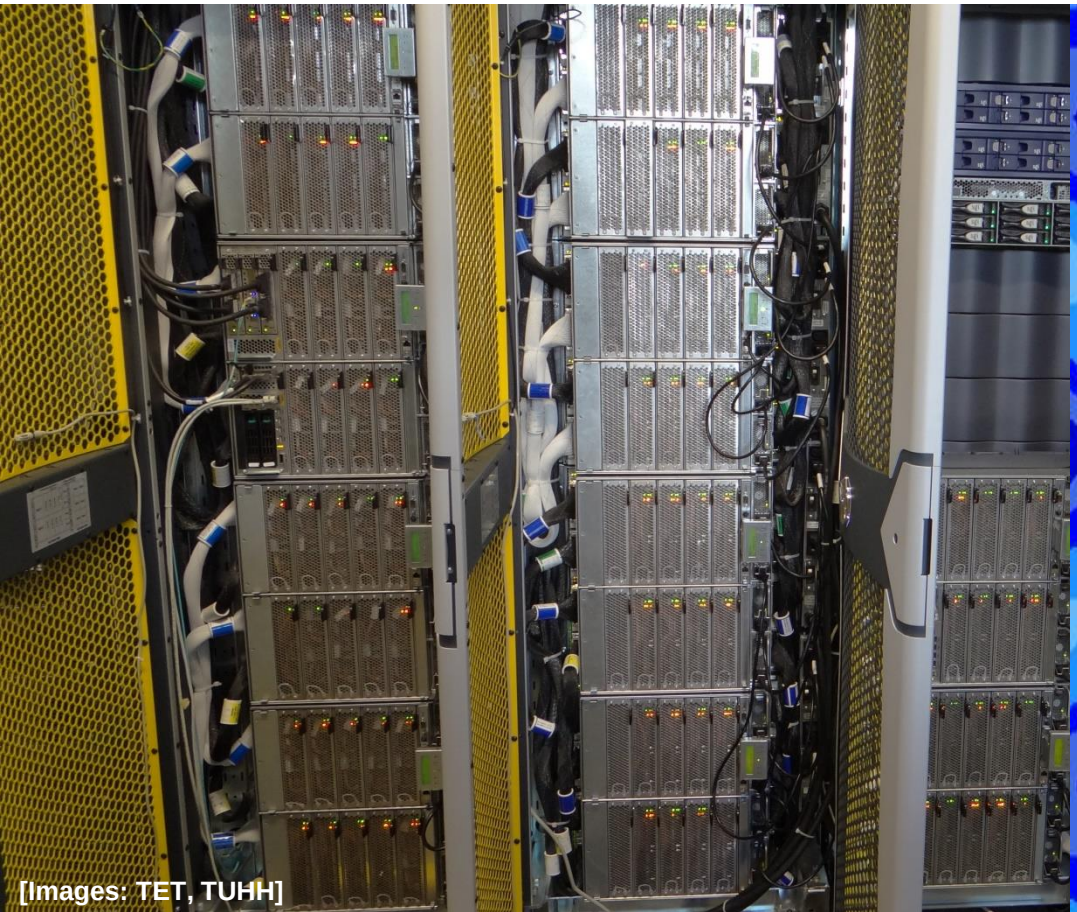
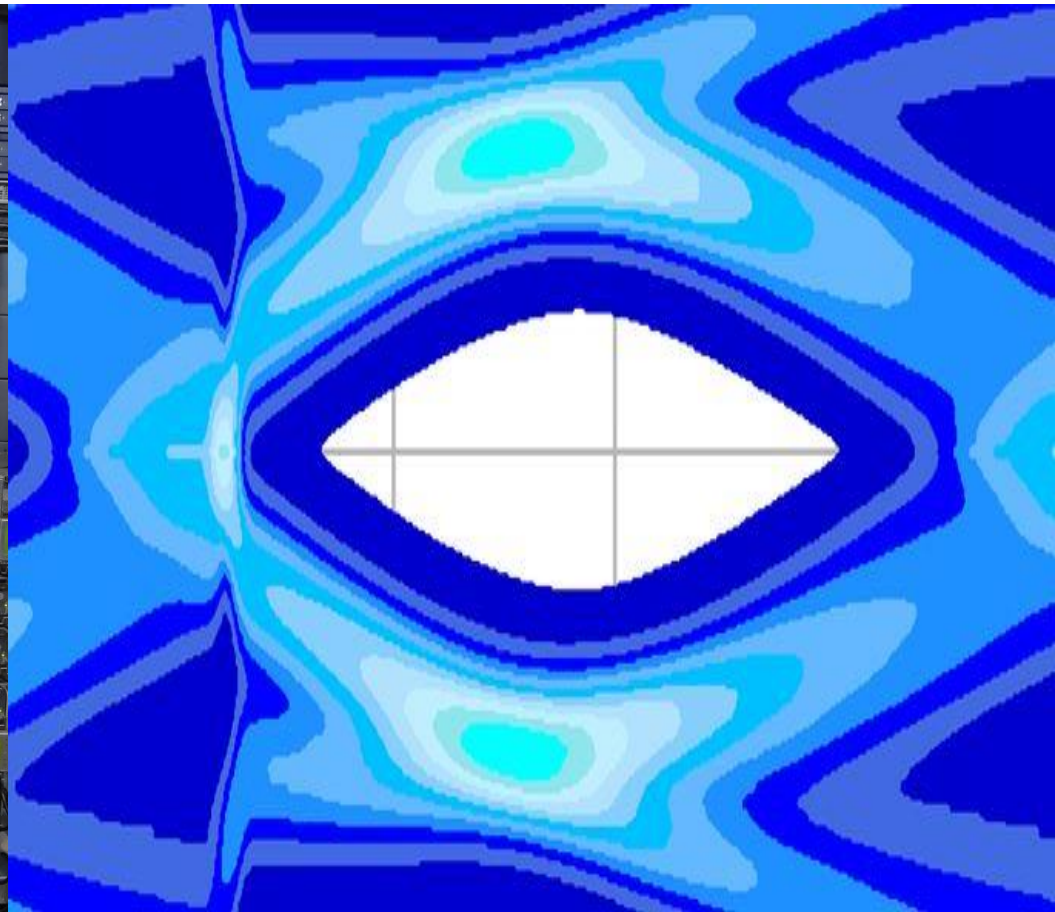
EMC II: Signal Integrity and Power Supply of Electronic Systems

Prof. Dr. sc. techn. Christian Schuster

Course Overview, Winter Term 2023/24





[Images: TET, TUHH]

What this is About

Nowadays, nearly all technical products contain electronic devices and circuits. Together with their packaging they constitute a complex electrical system that – ideally – works as designed and has no effects on or sensitivity to the environment. Obviously, this is not true.

In reality the **SIGNAL INTEGRITY**, i.e. the integrity of all signals transmitted, and the adequate **POWER SUPPLY** to all devices of the system is compromised by unwanted electromagnetic effects, non-ideal devices, and physical limitations of packages, interconnects, and materials.

In this course, the electrical design of signal interconnects and power supply systems will be analyzed, charaterized, and optimized. The course is the second (nevertheless independent) part in a series of two lectures on **ELECTROMAGNETIC COMPATIBILITY** (EMC).

Goals of this Course

After this course you should …

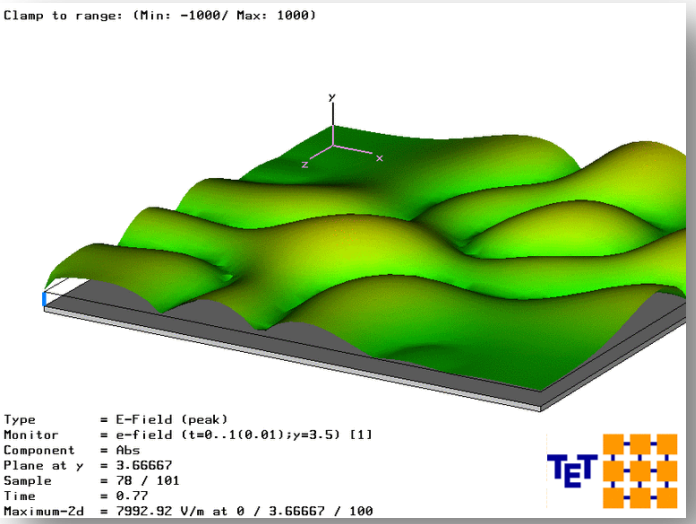
- know the most commonly used packages and interconnects
- know the most important signal integrity (**SI**) and power integrity (**PI**) problems associated with these
- know the basic SI measurement techniques
- be able to model (simulate) simple packages and interconnects
- be able to assess packages and interconnect structures with respect to SI and PI
- be able to analyze SI and PI issues, identify root causes, and propose ideas how to solve them

Curriculum

Week	Topics	Lecture Notes
1	Course Overview, Introduction to SI and PI, SI and PI as Elements of EMC	[00] – [02]
2	Modeling for SI and PI, Packaging of Electronic Systems, The I/O Challenge	[03] – [05]
3	Digital High-Speed Links, Digital Signal Bandwidth	[06] – [07]
4	Digital Link Modeling – Part I, Lumped Element Effects	[08] – [09]
5	Transmission Line Terminations	[10]
6	Transmission Line Losses	[11]
7	Transmission Line Stubs and Segments, Digital Link Modeling – Part II,	[12] – [13]
8	Transmission Line Crosstalk	[14]
9	Differential Signaling, Compensation and Cancelation	[15] – [16]
10	Digital Link Modeling – Part III, Digital Link Measurements, Power Delivery Problems and Modeling	[17] – [19]
11	Grounding and Decoupling	[20]
12	PDN Design and Optimization, Advanced PDN Design	[21] – [22]
13	Parallel Plate Effects, Return Currents and Vias	[23] – [24]
14	**Presentations by Students**, Wrapping Up EMC-II	[25]

Exercises & Experiments

Students will have an opportunity to get to know highly sophisticated software tools for the computation of electromagnetic fields and the analysis of signal and power integrity problems.



Both exercises and experiments will be organized by:

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Experiments will take place in the Institut für Theoretische Elektrotechnik (Blohmstr. 15) after a kick-off event in November.