EMC and PCB Design

TNE089, Electromagnetic Compatibility (EMC) and Printed Circuit Board (PCB) Design, 6 credits.

Background

Electromagnetic compatibility (EMC) issues are today a hot and growing technological area. However, even though it seems like a quite new area the basic problematics is virtually as old as the use of electrical power. More devices, compacter devices, low voltage (low power) devices are what really has launched the need for better understanding of electromagnetic compliance. Electrical devices running from 230 V alternating current (AC) plug are connected to each other via the power supply grid, and conducted emissions through the net must be considered and handled. "Radiated emissions", refers to unintentional radiation and is the second EMC emission leg. DC-powered systems, e.g., automotive have their own standards/regulations. Knowing what is needed when. What is measured when, why? Wireless applications are also more and more common, so-called intentional radiators must comply with given spectrum masks. Unintentional radiation from any electronics must also be controlled to meet device specifications and possibly performance. Except regulations, higher clock-speeds, i.e., shorter rise, fall-times give signals that cover wider spectrums and are meaner to adjacent circuits. Sometimes improved EMC performance, reduced EMC signature benefits functional performance. Sometimes they are on the opposite side. Components, circuits, reality isn't perfect. Secondly, the solution must be realistic from industrial perspectives, such as cost and manufacturability. What should we think of, and how can we make a better design trade-off for a specific case?

The Course

The course covers EMC fundamentals, from theory to design. As the major carrier of electronic components, the PCB is one important part affecting the EMC-performance of a electronic device/product. The primary focus is EMC issues, theory, technology, and importance. Seven lectures covering the EMC perspective from theory, regulations to practical considerations. Two lectures are focussed on PCB design and system aspects, i.e., the very final "system" rounds of the discussion. Both theory and technology are trained with labs. Theoretical knowledge, advanced skills, deep understanding, and analysis of electronics are practiced and tested with project work. Moreover, a written exam concludes the course. Lectures and computer labs will be concentrated mostly in the first period of the course, and the project will be the main focus in the second period.

Course organisation

Ht1 (First half of the semester): Lectures and computer labs.
Ht2 (Second half of the semester): A few classes, one measurement lab, and the project.

Lectures:
Power point is used; slides will be available on Lisam a day or two in advance.

Classes:
Mostly own work with problems from the textbook. The instructor might give some examples, but the majority of the time is intended for own exercises. Some possibility to adopt based on wishes.

Labs:

Preparation exercises are mandatory if there are any in the respective lab. Se the respective lab-sheets.

No written report. Examination of each lab at the end of the lab session. Hence, if the tasks are not finished in time, then it has to be finished on own time after the lab.

Project:

There will be proposals to select from, but own suggestions are encouraged.

Scheduled status meetings. Mandatory but ok to miss one or two if a valid reason is given in advance.

The project involves a project report. Some instructions will be given, apart from that senior undergrads are expected to know how to write a technical report.

The project must be presented with a power point (or similar tool) presentation at the end of the semester.

Written exam:

The written exam will be given in January.

The exam will be four hours (maximum).

Further details see “Written exam” on Lisam.

Course Literature

Paul R. Clayton, “*Introduction to Electromagnetic Compatibility*”, 2nd ed., ISBN-13: 978-0-471-75500-5, Wiley-Interscience, USA.

Examination

Written exam	2 credits
Lab course	1 credit
Project work	3 credits