ASEAN-EU university network programme on EMC and SI education.

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Abstract

This paper reports about a project for the creation of an innovative university course devoted to the preparation of future electronic designers to the challenges imposed by the assurance of the electrical performance of high-speed electronic systems. The target groups are future university teaching staff and future electronic systems designers. Activities are developed by means of sharing research results, seminars, experience exchange and the development of demonstrators to be used for teaching. The partnership is composed by Technical University of Turin (Italy), University of Hannover (Germany), University of Nottingham (UK), Nanyang Technological University (Singapore) and King Monguts Institute of Technology Ladkrabang, Bangkok (Thailand). The program is partially funded by the European Commission under the ASEAN-EU University Network Programme (AUNP) [1] and its duration is 24 months. Detailed information on the project development is in `http:\\www.aunp-emctraining.polito.it`.

Program Objectives

The purpose of this program is the preparation of future designers to the challenges imposed by the assurance of the electrical performance of high-speed electronic systems, that become more and more pervasive and fundamental in the modern society, from communications to bio-medical applications. The market trend in the electronic industry is essentially based on increasingly sophisticated high density and high frequency complex systems. Signal Integrity and ElectroMagnetic Compatibility constraints encountered during the realization of such systems are becoming stringent, so, as the costs for a physical implementation of these devices are prohibitively high, designers must be able to recognize and solve SI/EMC problems early during the design stage and not after the physical realization of the system. To achieve this goal, universities must train future teachers to be able to prepare in turn future electronic designers on such matters, always being up-to-date to the last research development in this field.

This project is a new kind of answer to the needs of European and ASEAN universities concerning SI/EMC aspects, by means of the collaboration between several research groups that have developed considerable experience over the years in those key areas of concern in current and future high-performance electronic systems, with the aim of building an updated knowledge base for designers instruction. The needs of the participating partners are complementary: ASEAN countries are the location where the fabrication of electronic circuits mainly takes place (integrated circuits as well as small systems); now they are trying to move also to electronic design. Thus, ASEAN universities are the location where future ASEAN electronic designers will receive their formal training, and they could have great benefits from a collaboration with EU Universities with a long experience in the field of research on electronic systems design. On the other hand, European Universities will benefit from the experience exchange with ASEAN Universities, because of their practical experience on actual problems and constraints arising from the field and related to the application of the most advanced and recent electronic technology. A long term collaboration and the realization of innovative course material (demonstrative Printed Circuit Boards and systems involving the major SI/EMC phenomena) is the core of this program.

Activities

The details of the project development, activities carried out and results are regularly posted on the project webpage `http:\\www.aunp-emctraining.polito.it`. The course of the project was mostly developed according to the results of a survey exercise on the EMC training needs of the electronic industries in both EU and ASEAN countries, that was carried out in January - March 2004. Survey forms were sent to more than one hundred electronic companies as well as to some postgraduate students in the universities, asking the following four major questions related to EMC education:

1. Have you attended any EMC course?
2. Do you think the knowledge acquired in the courses is useful for your job?
3. If an EMC course comes with a practical demonstrator that allows you to appreciate good and bad EMC design practices, do you think it will help you to understand the concept of good EMC design better?
4. What EMC design issues (e.g. crosstalk, conducted EMI, shielding, PCB layout, radiated EMI, etc.) you would like to include in the practical demonstrator?

The findings of the survey can be summarized as follows:

- About 85% of the participants have attended some forms of EMC training or courses.
- For those who have attended the EMC training or courses, close to 98% feel that the knowledge gained is useful for their work.
- For all the participants, whether or not they have attended any EMC course, close to 98% agree that a practical demonstrator that comes with EMC teaching will help them to understand the concept of good EMC design better.

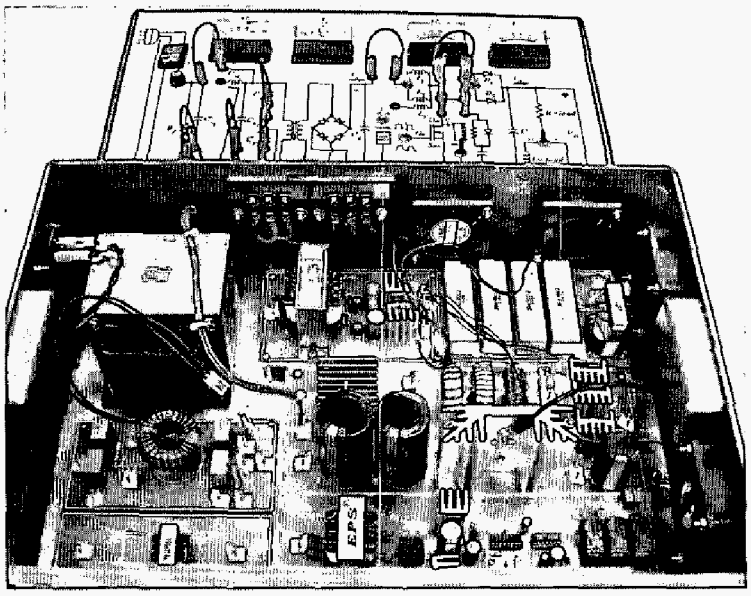

Figure 1: Demonstrative switched mode power supplier developed for the course of the project

- Most participants would like crosstalk, conducted EMI, shielding, PCB layout and radiated EMI to be included in the demonstrator.

In addition, useful suggestions were collected from the survey as important points for the delivery of an EMC course. Among these, the following deserve mention and were accounted for in the course development: explain the underlying physical phenomena without going into detailed theoretical derivations; web-based applications of design guide, checklist and simulation; schedule the courses for one week maximum; cover EMC regulations and standards; some basic EMC rules which are easy to remember and apply to product design; use of circuit simulator such SPICE to predict signal integrity, emission and immunity with simple models; introduce any simulation tools available where one can simulate or emulate the EMC/EMI performance.

According to the above results, a five-day intensive course is presently under development. The course is based on physical explanation of EMC phenomena, exploits dedicated demonstrators and includes practical parts involving hands on sessions and computer simulations. Emphasis is given to modeling and computer simulation, with the help of state-the-art simulation codes. The course content is organized as in the following outline and addresses the topics highlighted by the survey.

D.1 Basics of EMC and EM modeling (*Standards, regulations, shielding, EM modeling*)

D.2 Basics of Signal Integrity (*Interconnect, crosstalk, discontinuities, passive components and IC i/o buffers modeling; analysis, simulation and design of interconnecting paths*)

D.3 (morning) Signal integrity and interconnects issues at chip level (*Specific problems, models and results*)

D.3 (afternoon) EMI measurements and testing for EMC Compliance (*Test facilities, measurement procedures and testing center visit*)

D.4 Power delivery and radiation issues (*Power delivery systems, modeling and simulation of radiation*)

D.5 Power supply issues (*Power integrity and power supply generated noise*)

Demonstrators developed in the project and integrated in the course are boxed PCBs with logic circuits and switched power supplier, that are devoted to show radiation and power integrity effects, plus a complete switched mode power supplier devoted to show the power integrity and EMC issues of these systems. The project is planned to be completed in November 2005 and the first test of the course will take place in Thailand in July 2005.

Conclusions

The survey carried out in this project highlighted that the need of EMC design training in the electronic industry is real and this project actually addresses one of the major design challenges faced by the electronic designers. The idea of supporting EMC education and training with a practical demonstrator has been well received by the electronic engineers to be an effective tool for gaining EMC design knowledge and concepts. A complete and innovative course, including demonstrators, is being developed, that addresses crosstalk, conducted EMI, shielding, PCB layout and radiated EMI that are the major design issues arising in industry applications.

Acknowledgments

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[1] ASEAN-EU University Network Programme
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