

To Prof. V. Litovski

Subject: ***The SoC curriculum at the faculty of Electronic Engineering in Niš.***

Dear Sir,

Thank you for the letter of May 30, 2008.

Here is my observation related to the subject.

1. General

The chances of the students to start their professional carrier are in high extend dermined by the quality of the university curriculum. SoC design went through tremendous changing in the last decades, due to the development of both semiconductor technology and the design technology, as well as due to the market globalization, that has increased the dynamic of the SoC development. Clearly, every university has to adapt constantly to these changes; in the case of Serbian university, the need for alignment with the market request is even bigger, due to the economical isolation of the country during the 90's.

SoC design is a complex, multidisciplinary subject, comprising system architecture development, analog design, digital design, package design, semiconductor technology, embedded software development, quality and reliability aspects, design for test, design for manufacturing, etc. Although each of these fields is covered by appropriate specialists, it is required that the each engineer can have understanding of the other areas. For instance, saving the SoC energy consumption requires appropriate choice of process technology, low-power design architecture in both analog and digital design, but also appropriate system software that is written in order to reduce the data transactions in the system. Or, the noise interaction between digital and analog circuit make indispensible knowledge that spans both disciplines, including also packaging technology. Therefore, it is needed that the curriculum covers many disciplines of the SoC design and offers the students wide basis.

On the other hand, the curriculum has to enable collecting of practical knowledge. Time to market requires very efficient way of working. Students, which have hand-on experience in with the modern design tools, have better chances on the employment market. In the dynamic environment of technology, it cannot be predicted exactly which practical knowledge will be necessary in the years to come; but it is still important to provide the relevant experiences for the state-of-art of SoC design.

2. University curriculum (bachelor degree).

The purpose of this letter is to give opinion on the master degree studies. Those are, however, based on the bachelor program, so it is indispensible to align both curriculums.

Here is my opinion:

- + The list of the courses implies good coverage in fundamental sciences which are basis for the multidisciplinary SoC design (mathematics, physics, programming, etc.).

- + The curriculum provides possibility to acquire knowledge of analogue and digital design circuits.
- + The courses give hand-on experience on analog circuit design tools.

However:

- "Business correspondence" is an unnecessary subject.
- If there is possibility to add to curriculum non-technical subjects, the most important one is surely project organization/project management. Basic knowledge of economy can be also advantageous for the students.
- The design of digital integrated circuits is, according to my understanding of the curriculum description, not a mandatory course. For Master degree on the subject of SoC design, such course is necessary condition.

The curriculum does not describe the content of the particular courses. Therefore, I cannot give my judgment on this. Nevertheless, I want to mention below some of the skills that should be covered:

- Scripting programming languages, especially Tcl; since most of the design tools use Tcl interfaces.
- Programming language C
- Version control tools would be also of advantage
- Mentioned is hand-on experience with Mentor design tools; Cadence is however, nowadays the dominant on the SoC market.

3. Syllabi

The description of Master courses is not given in enough details.

- Coverage of analog design tools (simulation, optimization, modeling) is very good.
- There is practically no hand-on experience in digital design. Indeed the knowledge VHDL, which is a basic condition, is covered. Nevertheless, digital design spans many steps, being synthesis, simulation, static timing analysis, power drop analysis, noise analysis, digital place and route. Especially the issues of timing closure are important. Also, the notion of *design flow* is very relevant.
- Design for Test (including design for Manufacturing; Yield; Analysis, etc.) is a very important subject for SoC design that is not given enough attention.
- Course Intelligent machines is not fitting to the SoC design program.

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