

Doctoral Studies in the area of

Dependable Hardware - Software Systems

in cooperation with:

Poznan University of Technology

Technical University of Liberec

Tallinn University of Technology

Why Should Anybody Become a Specialist for Dependable Electronic Systems?

Europe is a continent whose countries have to live on some sort of national income. In many parts of Europe, particularly in the central, northern and north-eastern parts, tourism and agriculture cannot provide enough income. There are not many raw materials waiting to be mined. Recent history shows that even financial services are not a solid base. Apparently the production of manufactured goods such as electrical and electronic systems, vehicles, industrial plants and transportation systems is a more solid base.

Europe has been strong in these areas for decades, if not centuries, and this strength has become the key source of income for countries like Germany, Poland, the Czech Republic, France, and even Austria and Switzerland. Europe has lost also in these areas against Asian countries in the manufacturing of low-cost goods, but has maintained a strong position in goods and systems that are made for long-time dependable operation. European manufacturing companies cannot be extremely cheap for various reasons, and that means they have to very good to stack competitive.

The qualification of companies is essentially the qualification and the know-how of their work force, notably their engineers. In some sense, computer scientists are a special sort of engineers who do most of the software job.

By this time, European high-tech industry is booming, is creating new jobs by the thousands and has held a very good position in the world-wide competition even against the “rising” competitors. But now the lack of qualified manpower is becoming the real bottleneck for growth and the main reason of concern for European economic development. Even a country which is as rich in agriculture and natural resources as the United States apparently cannot have a prosperous economy if the workforce is dominated by an abundance of finance managers, economists, business administrators and lawyers with engineers becoming an endangered species.



Embedded Controller for Automotive Applications
(picture courtesy of Robert Bosch GmbH)

And as Europe has neither Wall Street nor Hollywood, but companies like BMW, Daimler-Benz, Audi, Skoda, Volkswagen, Bosch and Continental, which have all become more or less international, there is a real need for joint action by companies and universities to secure the qualification of the future work force. Most electronic systems of everyday use are now manufactured in Asia, such as mobile phones, smart phones, notebook computers, radios and TV sets. However, this loss is more

than compensated by the need for electronic sub-systems in “embedded” applications such as cars, trucks, trains, airplanes, tooling machines, industrial plants and even “smart” homes. The main difference between everyday electronics and embedded systems, however, is the required level of dependability and longevity. Cars have to give a reliable service for about 10-15 years, trains and airplanes are typically used for 30 years or more. Companies in Europe depend on the quality of their products, which need signed-in dependability, much more than the electronic products typically sold by Asian vendors today !



Application Specific Microprocessor
designed by students of Brandenburg University of Technology Cottbus and manufactured by Leibniz-Institute IHP of Frankfurt / Oder, Germany

This demand has become so strong that something has to be done in education. Traditionally, engineers and computer scientists have been educated to design systems that work after production. Now they must learn to design systems that show a dependable operation even in the presence of faults. This is a much more challenging job that has to be supported by efforts in education. And there must be young people who are willing to meet this challenge and who will go for this type of education. The chances for employments are bright, even with companies that have a long history of benefits for their workforce.

Education of First-Rate Experts

Learning to design either hardware or software for electronics systems with embedded computers is hard already. And typically it takes more than a 3-years bachelor program, even a master is hardly enough. Doctoral education in Europe traditionally had a focus on

in-depth research in a very narrow area with relatively little education towards an “extended overlook”, for example in all the basic technologies that make hardware / software systems highly reliable or dependable. Furthermore, teaching a post-graduate student the necessary topics that give her or him a “state-of-the-art” overlook is beyond the means of a single university. The range of topics is too large. Therefore the task is tackled by a consortium of European universities.

These universities are:

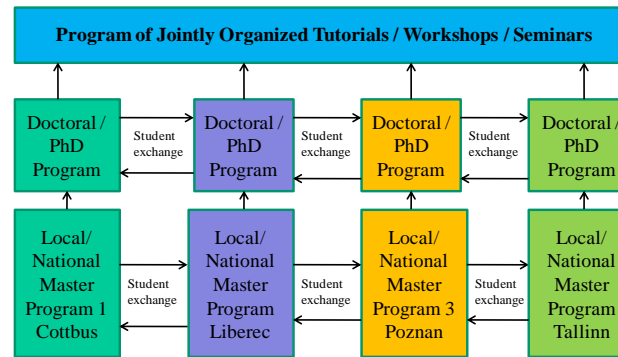
- Brandenburg University of Technology Cottbus, Germany
- Technical University of Liberec, Czech Republic
- Poznan University of Technology, Poland
- Tallinn University of Technology, Estonia.

These partners have started to join their efforts in high-level technical education. This means that each university has its own educational program at the Master- and PhD level, but the “comprehensive” overview on design and test technology for dependable hardware / software systems is made available to students by a jointly organized program of tutorials, seminars and workshops. Among several associated partners that also participate actively are:

- Leibniz Institute for Innovative Microelectronics (IHP) of Frankfurt / Oder, Germany
- Fraunhofer-Institute for Integrated Circuits (IIS), Department of Electronic Design Automation (EAS), Dresden, Germany.

The tutorial program includes not only block-tutorials given by professors of the participating universities, but it also includes tutorials given by external international experts in the field. The main topics addressed in tutorials and workshops are:

- Design and test technology for integrated circuits and systems
- Test architectures for integrated systems
- Test and fault diagnosis
- Built-in self test technologies
- On-line-test, error detection and fault-tolerant computing
- Design verification for hardware and software
- Reconfiguration and self repair
- Distributed systems and sensor networks
- Computer networks and communication
- Design models and design languages.



Organization of Collaborative Studies in the Area of Dependable HW / SW Systems

Mutually organized seminars and workshops also serve to bring together students from the participating universities for discussion and analysis of common problems and solutions. Researchers from other universities may participate as associated partners. The participating universities form a “PhD committee” which helps to conduct and supervise this system of courses. The members of this committee also participate in oral assessments of students, but all the examinations are under control and supervision by one of the participating universities. Students have access to all course materials from past and present courses and tutorials, which already make a unique collection of state-of-the-art documentation hardly to be found elsewhere. All courses and all course material are in English.

The creation of this jointly organized program of studies (ZUSYS) is supported by the German Academic Exchange Service (DAAD) as part of their IPID (international graduation in Germany) scheme.

How to Join

Persons who are interested to join are welcome as students or as active contributors. Prospective PhD students should have a master-level university degree in areas such as:

- Electrical / electronics engineering
- Computer science / computer engineering
- Information technology.

The basic programs of study are organized by the participating universities. Contact persons are:

- Prof. Dr. Ondrej Novak or Prof. Dr. Zdenek Pliva for TU Liberec (Czech Republic), ondrej.novak@tul.cz / zdenek.pliva@tul.cz
- Prof. Dr. Raimund Ubar or Dr. Jaan Raik for Tallinn University of Technology (Estonia), raiub@pld.ttu.ee, jaan@pld.ttu.ee
- Prof. Dr. Adam Dabrowski or Dr. Pawel Pawlowski Poznan University of Technology (Poland) , adam.dabrowski@put.poznan.pl
- Prof. Dr. H. T. Vierhaus for BTU Cottbus (Germany), htv@informatik.tu-cottbus.de.

Prospective students should have a look at the professors and their research areas at the potential host university, make a contact and identify possible areas of research.

The program so far has no resources for paying grants to students. However, students, after identification of a PhD supervisor and the prospective research area, will have good chances to obtain grants from national organisations such as the German Academic Exchange Service (DAAD) (not for German applicants !).

Brandenburg University of Technology Cottbus will start offering a specific program of studies towards a “PhD in Dependable Systems” from the fall of 2011.

See BTU’s web pages at:

<http://www.tu-cottbus.de/btu/en/gradschool/>

What Candidates Will Get

Successful candidates get the chance to obtain an internationally recognized doctoral (or PhD) degree in an area of science of technology that is of high interest for European and international companies. The normal length of studies is about 3-4 years, depending on specific university regulations. Chances for industrial and / or academic careers are excellent.

The contacts obtained from the jointly organized program of studies will make an excellent network for further industrial and academic collaboration.