PhD student or postdoctoral researcher position on the analysis and optimization of safety-critical embedded systems

DTU Compute would like to invite applications for a 3-year PhD position, or a 2-year postdoctoral researcher position, starting June 1st, 2015. The project is financed by EMC2.

Project Description

The Embedded Systems Engineering section at DTU Compute is looking for a PhD student or a postdoctoral researcher in the area of methods and tools for the analysis and optimization of safety-critical systems. The position is part of the large European project EMC2, “Embedded Multi-Core systems for Mixed Criticality applications in dynamic and changeable real-time environments”, with 99 academic and industrial partners from all over Europe. In this project, we have close collaborations with TTTech, SysGo, Volvo and Danfoss. The student or researcher is expected to participate in the project meetings and visits, for up to 6 months, one of the industrial partners.

A safety-critical cyber-physical system is a system that will not endanger human life or the environment. Many safety-critical systems are also real-time: in a real-time system the “correctness of the system behavior depends not only on the logical results of the computations, but also on the physical instant at which these results are produced”. A mixed-criticality system is “an integrated suite of hardware, operating system and middleware services and application software that supports the execution of safety-critical, mission-critical, and non-critical software within a single, secure computing platform”. For example, the embedded systems in a vehicle form a mixed-criticality system, as they implement safety-critical applications (e.g., ABS) and non-critical applications (e.g., diagnostics software). Economic pressures and multicore architectures are driving the integration of mixed-criticality applications onto the same platform. Certification standards require that safety functions of different criticality levels be protected (or, isolated), so they cannot influence each other.

We develop methods and tools (which requires developing complex software) for the analysis and optimization of mixed-criticality systems. We would like to continue the work we have done so far in the RECOMP and EMC2 projects, see these slides and the introduction to this PhD thesis. My group has worked with partitioned architectures, which use temporal and spatial separation mechanisms to ensure that applications of different criticality levels do not interfere with each other. At the processor level, we have proposed analysis and optimization methods and tools to determine the mapping of tasks to processors, the assignment of tasks to partitions, the sequence and size of the partition time slots on each processor and the schedule tables, such that all the applications are schedulable and the development and certification costs are minimized. This work was validated both on automotive case studies and an aerospace case study, in collaboration with NASA's Jet Propulsion Laboratory in Pasadena, California. Considering the trend towards the internet-of-things and systems-of-systems, we have also addressed Ethernet-based protocols, such as TTEthernet, which is well suited for mixed-criticality applications. We have proposed methods and tools for the analysis and design optimization of TTEthernet networks used to transmit mixed-criticality messages. This work was done jointly with the TTTech.

Requirements

The candidates must have a master degree in computer science and engineering (CSE) or equivalent academic qualifications. The candidates must have algorithmic thinking, and have knowledge of algorithms and data structures; knowledge of real-time systems (e.g., scheduling) is a plus. No knowledge of hardware is required. The candidates must be fluent in English, both speaking and writing.

Approval and Enrolment

The scholarship for the PhD degree is subject to academic approval, and the candidate will be enrolled in the ITMAN Graduate School Programme of DTU Compute. Information about the general requirements for enrolment and the general planning of the scholarship studies is included in the general rules at DTU, which may be obtained here or from the PhD program office at tel: +45 45251176 or + 45 45251177.
Assessment
The assessment of the applicants will be made by: Associate Professor Paul Pop.

Salary and appointment terms
The salary and appointment terms are consistent with the current Danish rules for PhD degree students.

Further Information
Further information concerning the project can be obtained from Associate Professor Paul Pop.

Further information concerning the application is available at the DTU Compute PhD homepage or by contacting PhD coordinator Ulla Jensen +45 4525 3359.

Application
Applications must be submitted in English as one single PDF, and we must have your online application by May 3rd, 2015. Please open the link in the red bar in the top of the page: "apply online" ("ansøg online").

Applications must include:
• application (letter of motivation)
• CV
• documentation of a relevant completed M.Sc. or M.Eng.-degree
• course and grade list of bachelor and master degrees
• Calculation of the weighted grade average, see guidelines here, course names must be translated to English
• A code snippet from any project you developed (your choice), together with a very short description
• An example technical text you have written in English

If one or more of the items requested above is missing, the application will be considered invalid.

All interested candidates irrespective of age, gender, race, disability, religion or ethnic background are encouraged to apply.

DTU Compute conducts research and provides teaching in the fields of mathematics, modeling and computer science. The expanding mass of information and the increasingly complex use of advanced technology in society demand development of advanced computer based mathematical models and calculations. The unique skills of the department are in high demand in IT innovation and production.

DTU is a technical university providing internationally leading research, education, innovation and public service. Our staff of 5,000 advance science and technology to create innovative solutions that meet the demands of society; and our 9,000 students are educated to address the technological challenges of the future. DTU is an independent academic university collaborating globally with business, industry, government, and public agencies.