Quality-driven Architecture Synthesis and Power Aware Design of Embedded SoCs

Presenter:
Dr. Lech Jozwiak, Eindhoven University of Technology

The recent spectacular progress in modern microelectronics has created ability to implement a complex system on a single chip, and facilitated common global networking and wireless communication. This way, it has generated a strong stimulus for further development of the embedded system area, and specifically, of the embedded SoCs. Many new sorts of highly integrated wireless, mobile and networked systems for known and new important applications are now feasible and affordable. These systems have important applications in virtually all areas of human activity, and can be embedded inside of medical devices, robots, machines, planes, cars etc. or even implanted in human or animal bodies. On the other hand, application of the system-on-a-chip technology means however that different mixtures of non-programmable and programmable (re-configurable) processors, various sorts of memories and communication circuitry, as well as various digital and/or analog circuits are implemented together on a single chip. It also results in more and more severe power and energy problems, and an increasing influence of various physical phenomena on the system's behavior and performance parameters with the progressing miniaturization. Embedded systems are especially difficult to design. In addition to the above listed issues: their design is highly innovative, they must continuously communicate with their surroundings and appropriately react in real-time to the signals from the surrounding when guaranteeing continuous service within the time constraints. They have to satisfy various application-specific constraints and objectives, and many of them are used in critical applications that impose extremely high quality requirements. The main aims of this tutorial are the following:

- to analyze the nature of the modern embedded SoC design problems, and to show which system, design and design automation concepts seem to be adequate to solve the problems,
- to consider the application of these promising concepts to the system-level design of embedded SoCs, when focusing on the quality-driven system-level design exploration, system architecture design, and hardware/software co-design of the heterogeneous hard real-time embedded multiprocessor SoCs, and on the EDA-tools supporting these complex design tasks,
- to discuss new quality-driven model-based automatic architecture synthesis methods and corresponding EDA-tools that enable effective and efficient multi-objective optimal architecture synthesis for complex hard real-time embedded heterogeneous multi-processor SoCs,
- to overview the power and energy issues in embedded SoCs and techniques to reduce power and energy.