M4 : Embedded Control Systems
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12/03/2007 – 16/03/2007

Control systems are becoming increasingly complex from the perspectives of both control and computer science. Today, even seemingly simple embedded control systems often contain a multitasking real-time kernel and support networking. At the same time, the market deman ds that the cost of the system be kept at a minimum. For optimal use of computing resources, the control algorithm and the control software designs need to be considered at the same time. The aim of this course is to give an overview of embedded control sy stems and of the use of control techniques in computer software systems. The focus of the course will be software implementation of control systems. Both multi-tasking real-time operating systems and simple event -based microprocessors will be considered. Special focus will be given to the interaction between the control and computing aspects, resulting in latencies and jitter, and how this can be handled, e.g., through temporal robustness techniques.

The course will cover the following topics: Introduction to embedded control. Computer implementation of control algorithms. Computing models for control. Schedulability theory. Fixed vs floating point arithmetics. Examples of embedded control systems. Integrated control and scheduling. Codesign tools (TrueTime and Jitterbug). Timing aspects of networked control. Control of computer software systems

Karl-Erik Årzén was born in Malmö, Sweden on October 4, 1957. He received his M.Sc in Electrical Engineering and PhD in Automatic Control from Lund University in 1981 and 1987 respectively. He was appointed as professor in automatic control in 2000. He has also worked for ABB Corporate Research during 1992 -1994. His research interests includes real -time systems, real-time and embedded control, control of compute r software systems, discrete event and sequential control, and intelligent control systems. He has published more than 120 journal articles and conference papers. He is the leader of the Control for Embedded Systems cluster within the EU/IST Network of Ex cellence ARTIST2 since 2004. He was the chairman of the IEEE Control System Society Technical Committee on Real -Time Control, Computing, & Signal Processing 1999-2002. He is vice chairman of the IFAC Technical Committee on Real -Time Computing & Control since 2002. In 2006 he received the Guido Carlo -Stella award from the World Batch Forum for his contributions to manufacturing automation.

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