Embedded System Design and Modeling

EE382V, Fall 2009
Lecture: TTh 3:30-5:00pm, ENS 109

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Description

Embedded computer systems are ubiquitous, integrated into many devices we interact with on a daily basis. Driven by ever increasing application demands and technological advances that allow us to put complete multi-processor systems on a chip (MPSoCs), system complexities are growing exponentially. Together with tight constraints and market pressures, this makes the system design process a tremendous challenge and well-defined design methods and design automation techniques crucial to its success.

This course presents state-of-the-art methods, tools and techniques for system-level design and modeling of complete multi-processor systems from specification down to implementation across hardware-software boundaries. Using the SpecC language and the System-On-Chip Environment (SCE), we will specify, simulate, analyze, model and design systems based on examples of real-life embedded applications.

Prerequisites

Embedded real-time system design and hardware/software interfacing (EE345M Embedded & Real-time Systems, or equivalent); Working knowledge of C/C++, algorithms and data structures (EE322C Data Structures, or equivalent); Digital hardware design and hardware description languages (EE360M Digital System Design using VHDL, or equivalent).

Topics

Embedded systems, electronic system-level (ESL) design; system-level design languages (SLDLs), SpecC, SystemC; Discrete event simulation semantics; Models of Computation (MoCs), FSMs, dataflow, process networks; System specification and analysis; System-level design methodologies and tools, partitioning, scheduling, network design, communication synthesis; System platform modeling, processor and RTOS modeling, transaction-level modeling (TLM) for communication; Embedded hardware and software implementation, cosimulation; System design examples and case studies.

Textbooks

Required

1. D. D. Gajski, S. Abdi, A. Gerstlauer, G. Schirner, *Embedded System Design: Modeling, Synthesis, Verification*, Springer, ISBN 978-1-4419-0503-1, 2009.

Optional

2. A. Gerstlauer, R. Doemer, J. Peng, D. Gajski, *System Design: A Practical Guide with SpecC*, Kluwer, 2001, ISBN 0-7923-7387-1.

3. T. Groetker, S. Liao, G. Martin, S. Swan, *System Design with SystemC*, Kluwer, 2002, ISBN 1-4020-7072-1.
4. F. Vahid, T. Givargis, *Embedded System Design: A Unified Hardware/Software Introduction*, John Wiley & Sons, ISBN 978-0-471-38678-0, 2001.

Grading

Homeworks:	20%
Labs:	20%
Midterm:	20%
Project:	40%

Oral discussion of homework problems is encouraged. However, be sure to submit your own independent solution. Copying of any part of a solution without explicit reference to its source is plagiarism and considered cheating. Labs and final projects can be done in teams. Collaboration on projects is encouraged and desired.

Students with Disabilities

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TTY or the College of Engineering Director of Students with Disabilities at 471-4382.

Outline (Tentative)

Week	Topic
1	Introduction
2	Methodology, design flow, modeling and languages
3	The SpecC System-Level Design Language
4	Models of computation: process-based
5	Models of computation: state-based
6	System specification, profiling and estimation
7	Design space exploration, system synthesis
8	Review, Midterm
9	Project discussions and proposals
10	Processor modeling and refinement
11	Communication modeling and refinement
12	System models, Transaction-level modeling
13	The SystemC system-level design language
14	Review and wrapup, *Thanksgiving holiday*
15	Project presentations