Report on ARTIST Summer School in China 2009

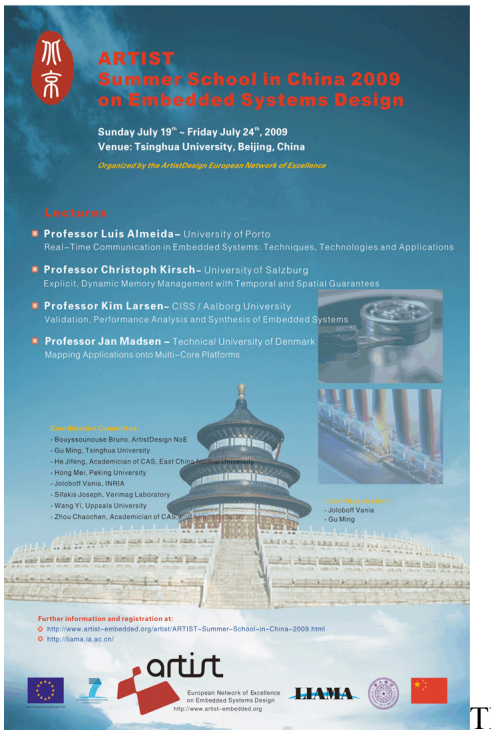
This is the final report for the ARTIST Summer School in China 2009.

1 Organization

A committee was formed to organize the ARTIST 2009 Summer School in China consisting of:
SIFAKIS Joseph, ARTIST NoE, INRIA/CNRS
BOUYSSOUNOUSE Bruno, ARTIST NoE
HE Jifeng, Shanghai East Central Normal University
MEI Hong, Peking University
GU Ming, Tsinghua University
ZHOU Chaochen, Academy o Science, Institute of Software
JOLOBOFF Vania, INRIA

The committee elected to have the school held at Tsinghua University, with local organization managed by Ming GU and Vania JOLOBOFF.

A poster mas made to advertise the Sumer School. The poster was sent Chinese Academy of Sciences Institutes and to major Universities including other Beijing Universities, Xi'An, Suzhou, Shanghai Jiaotong and ECNU, Changsha, Shenyang, Shanbu, Guangxi IT, Shantou and Hong Kong.



The ARTIST web site was set up to advertise the school, including the programme and a registration

form page.
http://www.artist-embedded.org/artist/ARTIST-Summer-School-in-China-2009.html

2 Technical Programme

The programme was set up to include several aspects of Embedded Systems Design: real time and in particular memory management in real time applications, real time distributed applications, and more formal methods with time automata theory and practice, all courses taught by distinguished scientists on the topic.

The courses were as described below.

2.1 Professor Luis Almeida

University of Porto, Portugal

Course:
Real-Time Communication in Embedded Systems: Techniques, Technologies and Applications
Abstract:
The proliferation of integrated communication interfaces within embedded computing platforms allowed an unprecedented level of distribution and integration that has been pushing frameworks such as Networked Embedded Systems (NESs), Wireless Sensor Networks (WSNs) and Mobile Ad hoc Networks (MANETs). In many applications, particularly involving transmission of live monitoring data, feedback control data or interactive multimedia data, there are timing constraints that must be respected for the applications to be effective. This requires bounded responses not only from the processors but also from the network. In this course we will analyse the concepts, techniques and technologies used at the network level to provide timely communication. In particular we will start from current trends in embedded systems design and from there we will address the timing issues in the network, the temporal control of communication, the protocol stack and its layers, we will revisit some related protocols covering both wired and wireless technologies, including CAN, FlexRay, Ethernet, WiFi and IEEE 802.15.4, we will analyse the traffic model and scheduling issues, and finally we will discuss some on-going related research projects.

Course:
Explicit, Dynamic Memory Management with Temporal and Spatial Guarantees
Abstract:
This course gives an introduction to the problem of explicit, dynamic memory management in systems that require temporal and/or spatial guarantees. Predictable memory management is key to introducing many higher-level programming abstractions to such systems. The course will focus on allocating, deallocating, and accessing contiguous pieces of memory using techniques ranging from basic but unpredictable methods such as Best-fit and First-fit to the latest, fully predictable method called Compact-fit. Students will hear about the fundamental problem of managing contiguous pieces of memory (fragmentation), and learn how to deal with it in general (compaction, coalescing) but also in real time (partial compaction) and in the presence of concurrency (incremental compaction).

2.2 Professor Jan Madsen

Technical University of Denmark

Course:
Mapping Applications onto Multi-Core Platforms
Abstract:
One of the challenges in modern embedded system design is to map the application onto a multi-core platform such that essential requirements are met. In order to do so at an early stage in the design process, where not all parts have been implemented or even designed, a system-level model of the application executing on the multi-core platform is needed. This model should allow for an accurate modeling of the global performance of the system, including the interrelationships among the diverse processors, software processes and physical interfaces and inter-connections. This course gives an introduction to the problem of mapping applications onto multi-core platforms. The process of mapping covers the allocation of tasks to processors of the platform and the definition of their execution order, i.e. the task scheduling. The course will focus on task scheduling for parallel systems. It will cover basic architectures for multi-core platforms (homogeneous and heterogeneous architectures) and how to model these, as well as how to model the application as a parallel program. The course will cover both basic scheduling algorithms (handling static scheduling) and more advanced algorithms, which are able to handle consequences of the, often complex, communication structures of the platform. The course will cover issues of real-time systems, including real-time operating systems (handling dynamic scheduling), as well as other quantitative aspects such as power consumption and memory usage. Finally, the course will give an introduction to how quantitative aspects of such systems may be formally modeled and analyzed.

2.3 Professor Kim Guldstrand Larsen

University of Aalborg, Denmark

Course:
Validation, Performance Analysis and Synthesis of Embedded Systems

Abstract:
Model-driven development is a key to dealing with the increasing complexity of embedded systems, while reducing the time and cost to market. The use of models should permit early assessment of the functional correctness of a given design as well as requirements for resources (e.g. energy, memory, and bandwidth) and real-time and performance guarantees. Thus, there is a need for quantitative models allowing for timed, stochastic and hybrid phenomena to be modeled and analyzed.

UPPAAL is a tool for modeling, simulating and verifying real-time and hybrid systems, developed collaboratively by BRICS at Aalborg University and Department of Computer Systems at Uppsala University since the beginning of 1995 (see www.uppaal.com). UPPAAL and the branches CORA and TIGA provide an integrated tool environment for modeling, validation, verification and synthesis of real-time systems modeled as networks timed automata, extended with data types and user-defined functions. The lectures will provide details on the expressive power of timed automata in relationship to embedded systems as well as details on the power and working of the UPPAAL verification engine.

During the lectures the demonstration and application of the UPPAAL tool suite will be given on a number of practical and industrial cases. Particular attention will be given to the theory of the underlying formalisms of the UPPAAL tool suite, including: timed automata, priced timed automata, and (priced) timed games addressing a number of associated decision problems related to model-checking and optimal scheduling and strategies. The lectures will highlight the by now classical region-construction underlying the decidability of several of these problems. Also, the frontier of decidability will be drawn including pointing out a number of open problems.

2.4 Pr. Ana Sokolova

University of Salzburg, Austria
Pr. Christoph Kirsch was scheduled to teach this course but was replaced at last minute (see below)

Course:

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3 Non Technical Program

3.1 Social Program

A visit to the Beijing Summer Palace was organized. As it is a fairly long visit, a bus was appointed to take the students to the Palace in the morning and pick up in the evening. It was organized as an informal visit so that the teachers and students could talk to each other during the visit.

During the conference, a common lunch was organized at the Tsinghua cafeteria with mixed students and teachers so they could continue interaction.

The audience consisted of young professors, post docs, PhD students and Master Students to have a blend of confirmed and less confirmed.

A T-shirt was made and distributed to all attendees.

3.2 Proceedings

Proceedings of the Summer School were made and distributed to all participants in electronic format in a USB key.