MOD259 – Elective Topic on Software Modelling and Verification (Spring 2012)

10 ECTS

Motivation and Objectives

An increasing number of software development projects are concerned with concurrent software systems, i.e., systems where communication, synchronisation, and resource sharing among software components are key aspects of the system. This includes projects involving Internet and Web service technology, protocols and multi-threaded applications, and embedded systems with sensor and actuators for control of, e.g., vehicles and industry equipment. The development of reliable software for such systems is challenging due to non-deterministic behaviour and independently scheduled software components. Software modelling and verification has emerged as a prominent paradigm based on the construction of formal executable models that can be used as a basis for early error-detection and verification of software. Furthermore, model-based approaches also provide a foundation for automated code generation. Recent industrial applications of software modelling and verification can be found in the domain of mobile phone software, device drivers, and mission critical software indicating that software modelling and verification is becoming an important element in many areas of software engineering.

Course Content

The course will cover the following main areas within software modelling and verification:

- Modelling languages and computer tools for behavioural modelling of software, including Coloured Petri Nets and CPN Tools [www.cpntools.org], Timed Automata and UppAal [http://www.uppaal.org], and Promela and the SPIN Tool [http://spinroot.com/spin] .
- Foundations, algorithms, and applications of state space exploration techniques for software verification, including languages for specification of behavioural properties.
- Tools and techniques for code-based software verification, including Java PathFinder [http://babelfish.arc.nasa.gov/trac/jpf]
- Software technologies and frameworks supporting model-based software development, including Eclipse platform frameworks such as EMF, GMF, and GEF.

The course will also include presentation of industrial case studies where the model-based approaches have been put into practical use for software verification and automated code generation.

Organisation

The course will be a combination of lectures and practical hands-on session with tools and technologies focussing on the practical application of software modelling and verification. In addition, there are a number of smaller assignments to be conducted in groups of 2-4 participants. Depending on the number of participants some of the smaller assignments may be replaced by a larger project and an associated project report.

Prerequisites

General admission requirements for the study programme. Programming skills corresponding to the course TOD063 Data Structures and Algorithms or the course INF102 Algorithms, Data Structures and Programming (UiB). Basic knowledge on UML class diagrams, state-transition diagrams, and activity diagrams is also assumed.

Assessment

Letter grading on the basis of a 30-minute oral exam.

Compulsory assignment

Taking the oral exam requires that the mandatory assignments have been approved.

Exam aids

None.

Litterature

The course will be based on selected chapters from textbooks, research articles, and online tutorials.

Subject responsible

Professor Lars M. Kristensen (lmkr@hib.no)