Mälardalen Real-Time Research Centre, MRTC, conducts research in cooperation with the industry, with the mission to provide research excellence that enables industry to take advantage of the opportunity provided by software in products and production systems.

World-leading competence in
- Embedded Software Development
- Real-Time Systems modelling and analysis

We offer
- Extensive experience of international projects
- Proven track record in industrial cooperation and commercialization of research
- A professional research organization with 13 professors, 30 PhDs, and 40 PhD students

Mälardalen Real-Time Research Centre (MRTC) is one of two Embedded systems research directions at the School of Innovation, Design and Engineering at Mälardalen University, MDH. MRTC is the leading research profile at MDH, and a national leader in Embedded Systems related research. Internationally, MRTC has extensive co-operation world-wide, and is known for its research in Real-Time Systems and Software Engineering, as well as its strong industrial links. Industrial partners include major companies, such as ABB, Bombardier, Ericsson, Scania and Volvo, as well as many smaller ones, including several spin-off companies.

MRTC provides a stimulating international research environment, characterized by its cooperative atmosphere, openness, and team spirit – a great environment for a researcher to grow in; with a mix of established and young researchers, including 10 full professors, 3 adjunct professors, 30 additional senior researchers, and close to 40 PhD students; several of which are employed or funded by industry. Research at MRTC has a dominating focus on Embedded Software, with a particular emphasis on component-based software development. MRTC’s mission is to provide research excellence that enables industry to take advantage of the opportunity provided by software in products and production systems. The research is organized in 10 mutually supportive and cooperating research groups with research on various aspects of embedded systems software engineering, real-time systems, data communication, and circuit design.

Professor Hans A Hansson is director of research at the School of Innovation, Design and Engineering, director of Mälardalen Real-Time Research Centre, and director of the PROGRESS national strategic research centre.
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MRTC's vision

- To provide state-of-the-art competence for industry
- To advance basic and applied research in relevant areas
- Education for engineers and researchers

The MRTC research is organized in following divisions and research groups:

Divisions
- Computer Science and Networks
- Embedded Systems
- Software Engineering

Research groups
- Business-Oriented Engineering of Software and Systems group
  Professor Jakob Axelsson
- Complex Real-Time Embedded Systems group
  Associate professor Thomas Nolte
- Dependable Software Engineering group
  Professor Sasikumar Punnekkat
- Formal modeling and analysis of embedded systems group
  Professor Paul Pettersson
- Industrial Software Engineering group
  Professor Ivica Crnkovic
- Model-Based Engineering of Embedded Systems group
  Professor Mikael Sjödin
- Programming Language group
  Professor Björn Lisper
- Real-Time Systems Design group
  Professor Hans Hansson
- Safety-Critical Engineering group
  Professor Kristina Lundqvist
- Wireless Communication group
  Professor Mats Björkman
Divisions at MRTC

Division of Computer Science and Networks
The mission of the Division of Computer Science and Networks is to provide education in all relevant aspects of Computer Science, and research in Computer Science both in itself and applied to areas such as Software Engineering, Computer and Real-time systems, and Electronic System Design. The goal is to strengthen and secure the Computer Science part of the education, and to provide scientifically well founded methods and theories for the application areas.

**Leader:** Rikard Lindell

Division of Embedded Systems
The mission of the Embedded System Division (ES) is to provide engineers with scientific methods and tools for designing safety critical real-time systems. The goal is to advance state-of-art and practice for developing such systems into a mature engineering discipline, i.e., in analogue with the scientifically well founded methods and tools for mechanical construction. ES develops methods for constructing safety critical real-time systems, ultimately capable of guaranteeing their multitude of requirements to be fulfilled.

ES is very research intensive and it has an internationally proved record of excellence in conducting high-quality research and has a very productive graduate training program. All research is performed in projects with specific goals with respect to achievements, publications, collaborations, and prototype tools. A project typically has elements of both basic and applied research. Equally important is the undergraduate education, where ES is responsible for computer engineering related courses, with a particular focus on computer based real-time systems. ES are responsible for the international Master Program in Intelligent Embedded Systems.

**Leader:** Paul Pettersson

Division of Software Engineering
The mission of the Division of Software Engineering (SE) is to provide education in all relevant aspects of Software Engineering, and research in Systems and software engineering for industrial and embedded systems. To establish world class education and research in this utterly complex area extensive collaboration with industry is required.

The research at SE is directed to increase the knowledge of software engineering and in particular of industrial software engineering, real-time and embedded systems component-based software engineering, dependable systems, from both theoretical and practical points of view. The research results of SE is supposed to be used both at the university and in the industry. At the university, the accumulated knowledge is used for further education in order to prepare the students for new aspects in system development. The industry will benefit with direct implementation of methods and knowledge built up in the research activities and well educated students.

Research Areas:
- Component-Based Software Engineering
- Software engineering for real-time embedded systems
- Software Configuration Management
- Product-line architectures for real-time systems
- Software Processes
- Dependable embedded systems
- Test and Verification
- Legacy systems modelling

**Leader:** Ivica Crnkovic
Research groups at MRTC

Business-Oriented Engineering of Software and Systems group

Focusing on problems related to the management of industrial product development, in particular software and systems engineering of embedded products.
Primary area: System and Software Evolution.
Members: Christer Norström, Ivica Crnkovic, Jakob Axelsson, Magnus Larsson, Peter Wallin, Stig Larsson, Anders Wall, Håkan Gustavsson, Pia Stoll, Joakim Fröberg, Hongyu Pei-Breivold, Rikard Land, Stefan Cedergren, Markus Lindgren, Frank Lüders, Daniel Sundmark

Leader: Professor Jakob Axelsson, jakob.axelsson@mdh.se

Complex Real-Time Embedded Systems group

Focusing on compositional execution and analysis of real-time systems, multiprocessor scheduling and synchronization, predictable execution of real-time systems and similar topics related to predictability of real-time systems.
We conduct research in the following areas:
- Compositional execution and analysis of real-time systems
- Multiprocessor scheduling and synchronization
- Predictable execution of real-time systems
- Source code analysis for industrial embedded software
- Simulation-based analysis of complex embedded systems

Leader: Associate professor Thomas Nolte, Thomas.nolte@mdh.se, +46 21 103178

Dependable Software Engineering group

Focusing on methods and processes for engineering dependable software systems, in particular in a combination of efficient development processes, and focusing on real-time, safety and reliability of the products.
Members: Yue Lu, Johan Kraft, Thomas Nolte, Moris Behnam, Insik Shin, Farhang Nemati, Mikael Åsberg, Holger Kienle, Nima Moghaddami Khalilzad

Leader: Professor Sasikumar Punnekkat, sasikumar.punnekkat@mdh.se, +46 21 107324

Formal modeling and analysis of embedded systems group

Focusing on formal modelling, analysis, and verification techniques for real-time embedded systems. In particular, formal syntax and semantics of component-based and service oriented models with extra-functional properties such as time or resources.
Members: Paul Pettersson, Cristina Secceleeanu, Jagadish Suryadevara, Stefan Björnander, Aida Causevic, Leo Hatzani, Anders Hessel, Eun-Young Kang

Leader: Professor Paul Pettersson, paul.pettersson@mdh.se, +46 21 151741
Industrial Software Engineering group

Leader: Professor Ivica Crnkovic, ivica.crnkovic@mdh.se, +46 21 103183

Focusing on engineering of complex software-intensive embedded systems, covering the entire lifecycle and including technologies, methods and processes. Particularly emphasis on component-based software engineering and component-models for embedded systems.


Model-Based Engineering of Embedded Systems group

Leader: Professor Mikael Sjödin, mikael.sjodin@mdh.se, +46 21 107323

Focusing on development of methods and tools for model-based engineering of embedded systems. Specializing in analysis of non-functional properties of component-based systems, and resource-efficient and predictable run-time infrastructures.

Members: Jukka Mäki-Turja, Damir Isovic, Federico Ciccozzi, Markus Bohlin, Dag Nyström, Rafia Inam, Mikael Sjödin, Andreas Hjertström, Saad Mubeen, Mehrdad Saadatmand

Programming Language group

Leader: Professor Björn Lisper, bjorn.lisper@mdh.se, +46 21 151709

Focusing on static program analysis for embedded systems, specializing in worst-case execution time analysis.

Members: Jan Gustafsson, Björn Lisper, Andreas Ermedahl, Johan Lindhult, Andreas Gustavsson, Stefan Bygde, Marcelo Santos, Linus Källberg, Amine Marref, Adam Betts

Real-Time Systems Design group

Leader: Professor Hans Hansson, hans.hansson@mdh.se, +46 21 103163

Focusing on design methods, architectures, and communication for real-time systems, with current emphasis on software testing and adaptive real-time systems.

Members: Hans Hansson, Sigrid Eldh, Yin Hang
Safety-Critical Engineering group

Focusing on bridging the theoretical foundations of dependability and industrial software development practices, with an emphasis on the technology and process aspects of complex dependable systems.
Members: Kristina Lundqvist, Andreas Johnsen, Jiale Zhou

Leader:
Professor Kristina Lundqvist,
kristina.lundqvist@mdh.se,
+46 21 101428

Wireless Communication group

Focus on research in wireless sensor networks; communication energy optimization, Safe and secure wireless industrial automation, Reliable wireless communication in harsh environments and Content distribution network optimization.
Members: Mats Björkman, Svante Ekelin, Johan Åkerberg, Henrik Abrahamsson, Andreas Johnsson, Mikael Ekström, Bob Melander, Elisabeth Uhlemann, Shahid Raza, Javier Ubillos, Mudassar Aslam, Svetlana Girs, Kan Yu, Mikael Ekström

Leader:
Professor Mats Björkman,
mats.bjorkman@mdh.se,
+46 21 107037
Research projects at MRTC

**ABV - Enabling Architecture Based Verification and Validation of Mission-Critical Systems**

**Leader:** Kristina Lundqvist  
**Members:** Kristina Lundqvist  
**Research group:** Safety-Critical Engineering  
**Start:** 2007  
**End:** 2012  
**Funding:** FP7 Marie Curie Reintegration grant

The overarching research goal of this project is to develop an integrated framework to support more effective verification and validation of mission-critical systems. Within this overarching goal, we define four measurable objectives:

1. Define the formal semantics of the AADL language
2. Develop test suite generation algorithms to support integration testing
3. Develop algorithms to enable effective regression testing
4. Engage industry to assess the feasibility and effectiveness of automated test case generation

**ALL-TIMES: Integrating European Timing Analysis Technology**

**Leader:** Björn Lisper  
**Members:** Björn Lisper, Jan Gustafsson, Andreas Ermedahl, Christer Sandberg, Stefan Bygde, Marcelo Santos  
**External:** Peter Altenbernd  
**Research group:** Programming Language  
**Start:** Dec. 1st, 2007  
**End:** May 31st, 2010  
**Funding:** European Commission’s 7th Framework Programme on Research, Technological Development and Demonstration.

The project has been concerned with embedded systems that are subject to safety, availability, reliability, and performance requirements. More often than not, these requirements relate to correct timing, most notably in the automotive and aerospace areas. Consequently, the need for appropriate timing analysis methods and tools is rapidly growing.

However, the existing timing analysis technology by far have not exploited the full potential of state-of-the-art approaches and recent research results. In the daily practice, there has been a lack of efficient methods and tools for timing assessment.

This is where ALL-TIMES comes in. Led by the WCET analysis group at Mälardalen University, an internationally recognized research group in the field of timing analysis, the project has aimed at:

- combining loose research results into a consistent methodology
- integrating available timing tools into a single framework
- developing new timing analysis methods and tools where appropriate

ALL-TIMES has enabled the interoperability of the various tools from leading commercial vendors and universities alike, and developed integrated tool chains using open tool frameworks and interfaces. In order to evaluate the tool integrations, a number of industrial case studies have been performed towards different end-user companies.

**APARTS - Advanced Program Analysis for Real-Time Systems**

**Leader:** Björn Lisper  
**Members:** Stefan Bygde, Björn Lisper  
**External:** Niklas Holsti (Tidorum LTD)  
**Research group:** Programming Language  
**Start:** 2010-12-01  
**End:** 2014-11-30  
**Partners:** Mälardalen University, Tidorum Oy  
**Funding:** EU (Marie Curie IAPP project)

The real-time performance of embedded software is often critical for the safety and quality of the software-controlled system. Recent research has made it possible to find safe bounds on the worst-case execution time (WCET) of a program by statically analysing the machine-code program. A crucial step is the analysis of the program’s computations on integer data. For instance, the program flow usually depends on such computations. Current WCET tools often require program flow constraints to be provided manually, which is cumbersome and error-prone. Better analyses of integer computations would reduce the need for such manual intervention. Such analyses must be both precise and correct.

The mathematical models for such analyses are usually formulated in terms of mathematical integers of unbounded size, while the program actually uses data stored in a fixed number of bits. This can lead to incorrect or imprecise results. We aim to improve WCET analysis by incorporating computation models that give bit-precise results reflecting the finite size of each variable and the possibility of overflow.

Most current WCET-analysis tools analyse the possible values of each variable separately, commonly producing an interval of possible values for each variable. However, the behaviour of the program, and thus its WCET, often depend strongly on the relationship between variable values. Ignoring such relationships can make the analy-
sis fail or give over-estimated WCET bounds. We aim to develop computation models that find and use such relationships, typically expressed as affine constraints between several variables. The end goal is WCET analysis with computation models that are both relational and bit-precise. We expect that this will increase the safety, precision, and level of automation of the analysis, and lead to WCET analysis tools that are easier to apply.

**ARIES - Applied Research in Industrial and Embedded Software**

**Leader at MDH:** Sasikumar Punnekkat  
**Members:** Sasikumar Punnekkat, Daniel Sundmark, Radu Dobrin, Frank Lüders, Thomas Nolte, Moris Behnam  
**Research group:** Dependable Software Engineering Group  
**Start:** 2010-06-01  
**End:** 2015  
**Partners:** Blekinge Institute of Technology (BTH), Halmstad University (HH), Mälardalen University (MDH), Swedish Defence Research Agency (FOI), Swedish Institute of Computer Science (SICS), SP Technical Research Institute of Sweden (SP)  
**Funding:** Knowledge Foundation, Sweden and RISE Holding AB  

ARIES brings together competences from three university excellence centres, three industrial research institutes, and a strong and diverse set of industry partners, forming a distributed centre of excellence in the field of industrial and embedded software-intensive systems. Especially, we target high-quality software on complex platforms, where we envision compositional components as a key ingredient and a joint focus of ARIES. Through our combined competencies in the areas of multi-/manycore, dependable and secure systems, and software engineering methods, we will target innovative solutions and knowledge towards a comprehensive view of how to develop industrial and embedded systems effectively through composable components.

**ARROWS - Design Techniques for Adaptive Embedded Systems**

**Leader:** Hans Hansson  
**Members:** Hans Hansson, Kristina Lundqvist, Thomas Nolte, Paul Pettersson, Cristina Seceleanu, Yin Hang  
**Research group:** Real-Time Systems Design  
**Start:** 2010  
**End:** 2012  
**Funding:** VR  

ARROWS project is dedicated to development of modeling, analysis and execution support for adaptive embedded systems. Traditional embedded systems typically have to satisfy static requirements on e.g., size, energy consumption, timing, and performance. Adaptive embedded systems must additionally be capable of dynamically reconfiguring to adapt to e.g., changes in available resources, user- or application driven mode changes, and modified quality of service requirements. The adaptivity provides flexibility that extends the area of operation and potentially reduces resource consumption, but also poses challenges in many aspects of systems development. The goals of the ARROWS project are to develop rigorous design techniques, platform mechanisms, and design methods for adaptive embedded systems. The following are the main research directions of the project:

- **formal models, verification techniques, and tools for adaptive behaviors and reconfiguration based on the theory of priced timed automata, task automata, and the UPPAAL tool**
- **design-time and run-time techniques for balancing conflicting requirements using stochastic models, simulation, model-checking,**
- **and run-time monitoring**
- **predictable dynamic resource management, extending the hierarchical scheduling framework with mechanisms for run-time reconfiguration and a calculus for abstract resources**
- **methods for traceability between different systems, platforms, and software specifications using timed abstract state machines to define transitioning between system representations**

**ArtistDesign**

**Leader:** Björn Lisper  
**Members:** Björn Lisper, Andreas Ermedahl, Jan Gustafsson, Stefan Bygde, Andreas Gustavsson  
**Research group:** Programming Language  
**Status:** active  
**Start:** 2008-01-01  
**End:** 2011-12-31  

Universidade de Aveiro, Lund University, University of Bologna, Verimag Laboratory, INRIA/IRISA, University of York, Scuola Superiore Sant’Anna CEA, Linköping University, Technische Universität Braunschweig, Technische Universität Kaiserslautern, Universidad de Cantabria, Ecole Polytechnique Fédérale de Lausanne, KTH, Uppsala University, University of Salzburg, Aalborg University, University of Passau, RWTH Aachen, Mälardalen University, Technical University of Denmark, IMEC, Technische Universität Dortmund, Technische Universität Wien, PARADES, ETH Zurich, Instituto Politécnico do Porto - ISEP-JPP, Universität des Saarlandes  
**Funding:** EU FP7 Network of Excellence  

ArtistDesign is a driving force for federating the European research community in Embedded Systems Design. It brings together 31 of the best research teams as core partners, 15 Industrial and SME affiliated industrial partners, 25 affiliated academic partners, and 5 affiliated international collaboration partners who participate actively in the technical meetings and events.
The central objective for the ArtistDesign European Network of Excellence on Embedded Systems Design is to build on existing structures and links forged in the FP6 Artist2 NoE, to become a virtual Center of Excellence in Embedded Systems Design. This is mainly achieved through tight integration between the central players of the European research community. These teams have already established a long-term vision for embedded systems in Europe, which advances the emergence of Embedded Systems as a mature discipline.

The research effort aims to integrate topics, teams, and competencies, through an ambitious and coherent research programme of research activities which are grouped into 4 Thematic Clusters: “Modelling and Validation”, “Software Synthesis, Code Generation, and Timing Analysis”, “Operating Systems and Networks”, “Platforms and MPSoC”. “Transversal Integration” covering both industrial applications and design issues aims for integration between clusters.

The NoE has a very dynamic International Collaboration programme, interacting at top levels with the best research centers and industrial partners in the USA: (NSF, NASA, SRI, Boeing, Honeywell, Windriver, Carnegie Mellon, Vanderbilt, Berkeley, UPenn, UNC Chapel Hill, UIUC, etc) and in Asia (Tsinghua University, Chinese Academy of Sciences, Seoul National University, East China Normal University, etc).

ArtistDesign also has a very strong tradition of Summer Schools, Graduate Courses, and major workshops. ArtistDesign builds on existing international visibility and recognition, to play a leading role in structuring the area. The Scientific Coordinator for the ArtistDesign European Network of Excellence is Joseph Sifakis (VERIMAG Laboratory).

**ASIS - Architecture-based verification of software-intensive systems**

**Leader:** Kristina Lundqvist  
**Members:** Andreas Johnsen  
**Research group:** Safety-Critical Engineering  
**Start:** 2009  
**End:** 2011  
**Funding:** VR  

In order to reach the goal of automating test case generation from architecture specifications, a number of tasks needs to be performed. We have started by focusing on the following tasks. 1) Support of model transformation without loss of meaning, 2) Developing a technique for automated testing, 3) Through execution and model checking of the specification be able to carry out dynamic analysis and verify that the architectural specification correctly passes data and control.

**BARTAP - Network Measurement Applications**

**Leader:** Mats Björkman  
**Members:** Mats Björkman, Andreas Johnsson  
**Research group:** Wireless communication  
**Status:** active  
**Start:** 2008-01-01  
**End:** 2010-12-31  
**Partners:** MDH, Ericsson  
**Funding:** VINNOVA

Project BARTAP aims at applying the BART network capacity measurement method to two types of applications, streaming media and network tomography.

**CHESS**

**Leader:** Mikael Sjödin  
**Members:** Christer Norström, Mikael Sjödin, Antonio Cicchetti, Daniel Flemsström, Sasikumar Punnekkat, Federico Ciccozzi, Mehrdad Saadatmand, Barbara Gallina  
**Research group:** Model-Based Engineering of Embedded Systems  
**Status:** active  
**Start:** 20090101  
**End:** 20111231  
**Partners:** Enea AB, Ericsson AB  
**Funding:** Artemis and VINNOVA

CHESS seeks industrial-quality research solutions to problems of property-preserving component assembly in real-time and dependable embedded systems, and supports the description, verification, and preservation of non-functional properties of software components at the abstract level of component design as well as at the execution level. CHESS develops model-driven solutions, integrates them in component-based execution frameworks, assesses their applicability from the perspective of multiple domains (such as space, railways, telecommunications and automotive), and verifies their performance through the elaboration of industrial use cases.

**COMING**

**Leader:** Antonio Cicchetti  
**Members:** Hans Hansson, Antonio Cicchetti  
**Research group:** Industrial Software Engineering  
**Start:** May 1st, 2010  
**End:** April 30th, 2012  
**Funding:** Marie Curie Intra-European Fellowships for Career Development (IEF), 2009, Individual Fellowship

The research proposed in the COMING project aims at exploiting the interplay between Model-Driven Engineering (MDE) and Component-Based Development (CBD) for an improved embedded systems development process. In particular, it focuses on the precise formalization of CBD concepts in a MDE setting as the definition of corresponding Domain-Specific Languages; moreover, the subsequent exploitation of MDE design/analysis methodologies will disclose the possibility to cope with current challenges in CBD, like domain independence, incremental and distributed development involving language interoperability, system maintenance, and validation.
Development of Software Intensive Systems in Complex Organizations

Leader: Anders Wall
Members: Anders Wall, Christer Norström
Research group: Industrial Software Engineering
Start: 20081201
End: 20101201
Partners: ABB Corporate Research
Funding: KKS

Managing development of software intensive products successfully in complex, often geographically distributed, organizations is a key factor for successful business. This is also crucial for Swedish industry developing software intensive products given the increased globalization that we currently experience. This project suggests a holistic view on software development taking everything from business strategy, development processes and organization, to technology e.g. the software architecture.

DICES - Distributed Component-based Embedded Software Systems

Leader: Ivica Crnkovic
Members: Ivica Crnkovic, Jan Carlson, Ana Petricic, Luka Lednicki, Juraj Feljan
External: Mario Zagar (University of Zagreb)
Research group: Industrial Software Engineering
Start: 2008-03-01
End: 2011-02-28
Partners: MRTC, Mälardalen University University of Zagreb Faculty of Electrical Engineering and Computing University of Split, Faculty of Electrical Engineering Ericsson Nikola Tesla, Croatia
Funding: Unity through Knowledge Fund, PROGRESS, MRTC, Mälardalen University, Ericsson Nikola Tesla, Croatia

DICES (Distributed Component-based Embedded Software Systems) has a goal to advance development of distributed embedded software systems with emphasis on software reusability and predictability of software quality. The aim of the project is increasing the software development efficiency and quality by applying service-oriented and component-based approaches. The project will advance theories and methodologies for prediction of certain system properties, develop tools that will help in reusability of software components, and assure performance efficiency of the systems. The overall presence of distributed embedded systems in the modern society is a fact. Examples of such systems are telecommunication systems, grid systems, control and information systems of vehicular systems (cars, trains), different monitoring environmental systems. Embedded systems development is one of the strategic research areas of EU-FP7 programmes. It is also of significant importance in Croatia, since many leading companies in Croatia either produce such systems (e.g. Koncar, Ericsson Nikola Tesla) or use such systems (e.g. Pliva). DICES will address efficient reusability of software components and prediction of the important properties for embedded systems: resource utilisation, and performance, by applying the service-oriented software engineering and component-based software engineering methods and technologies. The project will apply existing and develop new theories for predictability of certain quality attributes providing a) improved and more efficient software development b) optimal solutions of software architecture and components configurations for distributed systems. The theories will be validated on a case “ForestFire - Intelligent Forest Fire System” developed at FESB Split. This will enable a thorough validation of the approach and provide input for further development of this system and possible commercialisation of the improved product. Further, abilities of commercialisation, and possibilities of Open Source publicity will be investigated. The additional goal of DICES is improving the structural research potential in the field of Software Engineering in Croatia. The project will contribute in establishment of network of excellence in software engineering in Croatia by performing DICES on two Croatian and one Swedish research centre and by connecting DICES to several projects performed in Sweden and EU. The project will also work on strategic planning for continuation of activities and building careers of young researchers to avoid "brain drain". DICES have good assumptions for a successful performance since the participants have already established a successful cooperation, such as common work in education, organisation of some events, and submissions to Croatian and EU research proposals.

ECSS - Efficient Certification of functional Safety for Software systems

Leader: Ivica Crnkovic
Members: Ivica Crnkovic, Mikael Åkerholm, Rikard Land. External: Christian Strzyz (CrossControl)
Research group: Industrial Software Engineering
Start: 2009-05-01
End: 2011-05-01
Partners: CrossControl
Funding: KKS

The goal is to develop an efficient approach for development of software that is certifiable with respect to functional safety. To efficiently develop such software systems today, without doubt, one of the greatest challenges for Swedish machine and automotive industry. Manufacturers are today under great pressure to certify their systems due to legislation, for example, the Machinery Directive, EU Directive 2006/42/EC, which comes into legal force from December 29, 2009. Certifying software systems with respect to functional safety requires qualitative evidence of compatibility to a comprehensive development process, that extensive safety analysis have been conducted, and that the safety related functions in the software have been tested in a convincing way - and these functions are often hard to test at all. In practice this implies that each line of source code becomes much more expensive to develop. We are looking for an efficient development process that is compatible with the requirements of safety standards in combination with model-based and component-based strategies.
**EEMDEF - Execution Environment Modeling of Distributed Embedded Functions**

**Leader:** Jukka Mäki-Turja  
**Members:** Jukka Mäki-Turja, Mikael Sjödin  
**External:** Kurt-Lennart Lundbäck (Arcticus Systems AB), John Lundbäck (Arcticus Systems AB), Jimmy Westerlund (BAE Hägglunds)  
**Research group:** Real-Time Systems Design  
**Start:** 200901  
**End:** 201201  
**Partners:** Arcticus Systems AB & BAE Systems Hägglunds  
**Funding:** KKS & PROGRESS  

EEMDEF is a research project supported by KK-foundation and PROGRESS. In this project Mälardalen Real-Time research Centre (MRTC) cooperates with Arcticus Systems AB & BAE Systems Hägglunds to define a model based approach through component based technology for distributed embedded systems that lends itself to analysis and synthesis.

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**Embedded Systems Verification using Timed Automata Technology (VR)**

**Leader:** Paul Pettersson  
**Members:** Leo Hatvani, Cristina Seceleanu, Paul Pettersson  
**Research group:** Formal modeling and analysis of embedded systems  
**Start:** 2009-01-01  
**End:** 2011-12-31  
**Partners:**  
**Funding:** Swedish Research Council (VR)  

The main motivation of this application is the need for design techniques to support the development of software in embedded systems. In such systems, the software is embedded into a hardware product, and must operate correctly with respect to timing constraints, while using limited resources, such as CPU, energy, memory, bus bandwidth, etc. Hence, an important concern during the design of such systems is to predict that the limited resources of the target platform will not be exceeded. Automated mathematical techniques that would guarantee all of the previously mentioned behaviours, starting from early design stages, are still missing. This project will focus on research in this problem area, with the goal to develop formal description techniques for embedded systems based on automata theoretic approaches, supporting the early development life-cycle phases with prediction analysis techniques for abstract design descriptions. The following will be the main research directions of the project:

- an automata theoretic approach based on combining the models of priced timed automata and task automata to develop a formal modeling framework for function, timing, and resources in embedded system applications  
- algorithmic techniques for verification of functional, timing, and resource consumption of embedded systems, and  
- a tool for automatic verification of the proposed model, based on the existing tools Times and Uppaal.

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**ESTER**

**Leader:** Joakim Fröberg  
**Members:** Joakim Fröberg  
**Research group:** Complex Real-Time Embedded Systems  
**Start:** 2008-04-01  
**End:** 2010-04-01  
**Partners:** The project is run in the collaboration of Volvo Construction Equipment and Mälardalen University. The network of informal partners having shown interest in similar topics includes several other Volvo companies (including Volvo Trucks and Volvo Bus), CC-systems, Scania, Volvo Car Corporation, Bombardier, and ABB Corporate research. Academic partners includes the BESS research group and partners therein.  
**Funding:** The project is funded in half by Volvo Construction Equipment and half by the KK-Foundation. It is the vision of the proposed research to provide improved systems engineering capabilities that enables increased system quality and predictability of project execution for automotive electronic systems. The ESTER project has three blocks of activities that together constitute the body of the project; Research, Industry workshops, and common courses. We intend to disseminate the results via seminars and courses with industry and academic partners.

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**EURECA**

**Leader:** Sasikumar Punnekkat  
**Members:** Sasikumar Punnekkat, Radu Dobrin  
**Research group:** Dependable Software Engineering  
**Start:** 2008-07-15  
**End:** 2011-04-15  
**Partners:** Sofia University, Bulgaria, University of L’Aquila, Italy, University of Limerick, Ireland, University of Paderborn, Germany, University of Turku, Finland, University of York, UK, Uppsala University, Sweden, VU University Amsterdam, Netherlands, Amrita University, India, Indian Institute of Information Technology and Management- Kerala, India, Indian Institute of Technology-Kanpur, India, Institute of Engineering, Tribhuvan University, Nepal, Lahore University of Management Sciences, Pakistan, University of Colombo, Sri Lanka, XLRI Jamshedpur, India and KTH, Sweden (Associate Partner)  
**Funding:** EU- EMECW  

The EURECA project aims to establish a Eurasian academic mobility Network, for achieving excellence in research and education in a global context, by identifying key themes for cooperation, leveraging on the complementary competencies and providing synergies essential for the progress and mutual benefit of the targeted Asian countries as well as the European Union. The consortium comprises of 16 prominent educational institutions (9 from Europe and 7 from Asia) and is coordinated by Mälardalen University, Sweden. The exchange of personnel, knowledge and competences in multiple study domains of science and technology by our consortium is expected to have a positive and long ranging impact on the socio-economic development of Asia in a sustainable manner. On the other hand, EU
will gain knowledge about the socio-technological setup prevailing at the developing Asian countries and will be able to engage in long-standing business relations with the Asian economies. The consortium partners have special competencies/requirements in the study areas such as Software Engineering, Computer Science, Electrical Engineering, Business studies and Management Sciences, and pay special attention to the mobility needs in these identified thematic fields. Our primary goal is to find top talents from Asia and help them to achieve highest level of excellence in research and education. Additionally, we aim to provide the necessary impetus to the educational systems prevailing at various Asian partner institutions to comprehend and adapt the European educational models and values to the extent feasible. With a funding of of nearly 5 million Euros, EURECA project already facilitated about 200 students/researchers/faculty from Asia/EU to conduct a part of their study at one of the partner institutions.

**FIND - Flexibility in Industrial Systems**

**Leader:** Ivica Crnkovic  
**Members:** Johan Fredriksson, Ivica Crnkovic  
**Research group:** Industrial Software Engineering  
**Start:** 2009-06-01  
**End:** 2011-06-01  
**Partners:** ENEA AB  
**Funding:** KKS  

The project aims to create conditions and a framework for developing a research center, by developing the prerequisites for a graduate school at ENEA in collaboration with the MRTC. The technical part of the research aims to increase the predictability of time behaviour in large industrial embedded real-time systems. It is important that technology transfer takes place so that the techniques and methods will become easily accessible. An important part of this is to develop rules, frameworks and tools. The projects activities include case studies to understand the methods that can be used in the development of industrial software.

**GAUSS - Guaranteed automation communication under severe interference**

**Leader:** Mats Björkman  
**Members:** Mats Björkman, Maria Lindén, Svetlana Girs, Kan Yu, Marcus Bergblomma, Martin Ekström, Mikael Ekström, Johan Åkerberg, Mikael Gidlund  
**Research group:** Wireless communication  
**Start:** 2009-01-01  
**End:** 2012-12-31  
**Partners:** VG Power and DELTA  
**Funding:** KKS  
**Overview:** The project investigates how safety in wireless communication can be guaranteed in spite of electromagnetic interference.

**Hi5 - A Holistic and Improved Infrastructure for Increased Industrial Impact of research**

**Leader:** Ivica Crnkovic  
**Members:** Ivica Crnkovic, Kristina Lundqvist, Sasikumar Punnekkat, Paul Pettersson, Hans Hansson, Christer Norström, Malin Rosqvist, Stig Larsson  
**Research group:** Industrial Software Engineering  
**Start:** 2008-01-01  
**End:** 2011-12-31  
**Partners:** ABB, CC Systems, Ericsson, Prevas, Volvo CE  
**Funding:** Vinnova, ABB, CC Systems, Ericsson, Prevas, Volvo CE  

Hi5 is a project at Mälardalen Real-Time Research Centre (MRTCs) that has a goal to increase the cooperation and synergy of the activities between the research and industry. The three instruments are used to achieve that goal: (i) Increased cooperation on Master education (in particular Software Engineering master program), (ii) increased mobility between academia and industry for PhD students (both industrial and academic (PhD students) and (iii) increase mobility and increase cooperation on Postdoc/expert and specialist level.

**HISCORE - Hierarchical Scheduling of Complex Real-Time Embedded Systems**

**Leader:** Thomas Nolte  
**Members:** Thomas Nolte, Mikael Åsberg, Moris Behnam, Farhang Nemati, Insik Shin  
**Research group:** Complex Real-Time Embedded Systems  
**Start:** 2008-01-01  
**End:** 2011-12-31  
**Funding:** Swedish Research Council (VR)  

Most of today’s complex embedded systems must satisfy extra-functional requirements for proper operation, i.e., in addition to correct function, there are important requirements on, e.g., timeliness, reliability and energy consumption. It is desirable to be able to construct a system from multiple subsystems, since subsystems are often provided by different suppliers, and since partitioning provides a basis for complexity reduction. However, subsystems often share logical resources, e.g., memory areas, hence making it hard to independently develop and validate subsystems. Moreover, integration of these semi-independent subsystems may be difficult due to intricate dependencies. For independent subsystems, hierarchical scheduling has shown to be useful in preserving the extra-functional property of timeliness. In this project we will develop and generalize hierarchical scheduling frameworks allowing for semi-independent subsystems, thus making hierarchical scheduling frameworks suitable for deployment in complex (real) architectures, such as those encountered in the automation, telecom, and vehicular domains. More specifically we will develop abstract representations of hierarchically scheduled semi-independent subsystems on uni-processor, distributed and multiprocessor architectures. For each of these, we will develop appropriate synchronization protocols and associated real-time analysis.
**IRIL – Industrial Research and Innovation Lab**

**Leader:** Daniel Flemström  
**Members:** Daniel Flemström, Farhang Nemati, Frank Lüders  
**Research group:** Software Engineering Group  

The Industrial Innovation and Research Lab (IRIL) is an initiative from Ericsson and ABB to find top-talents and bring them into academic and operational excellence. Together with some of the most prominent multinational companies in Sweden, MRTC and MDH have created an environment, encompassing both industrial hardware and development environment as well as testing frameworks. The idea is to create an innovative multi cultural environment and to create new points of cooperation between the participating companies. Within the lab we run regular thesis works side by side with research projects as well as refresh education for employees and personal management courses.

Projects are run in close research–industrial cooperation to get the best from the academia and industrial experiences.

Since the start we have run a lot of theses in many different disciplines such as Model Based Development, Performance Engineering, Integration and verification and even Management subjects like open innovation and how to recruit and manage young talents.

**MRTV - Mälardalen Real-Time Virtualizer**

**Leader:** Thomas Nolte  
**Members:** Mikael Åsberg, Moris Behnam, Thomas Nolte  
**Research group:** Complex Real-Time Embedded Systems  

This is an umbrella project of the CORE research group, collecting results related to virtualization. Contributing research projects include HISCORE, PRESS and PROGRESS.

**OPEN-SME Open-Source Software Reuse Service for SMEs**

**Leader:** Ivica Crnkovic  
**Members:** Ivica Crnkovic, Sasikumar Punnekkat, Adnan Causevic  
**Start:** 2010-06-01  
**End:** 2012-06-01  

The OPEN-SME project aims to develop a set of methodologies, associated tools and business models centred on SME Associations, which will enable software SMEs to effectively introduce Open Source Software Reuse practices in their production processes. In this scope, software reuse is regarded as the sharing of software modules across different development teams, organisations, and diverse application domains.

http://www.mrtc.mdh.se/index.php?choice=projects&id=0336

**PRESS - Predictable Embedded Software Systems**

**Leader:** Thomas Nolte  
**Members:** Thomas Nolte  
**Research group:** Complex Real-Time Embedded Systems  
**Start date:** 2011-01-01  
**End date:** 2015-12-31  

**Funding:** The Swedish Foundation for Strategic Research (SSF)

For most of today’s embedded software systems, correct operation requires not only correct function, they must additionally satisfy extra-functional properties, in particular related to resource usage and timing. The goal of this project is to develop new resource reservation techniques for distributed embedded software systems; techniques allowing for design-time and run-time management of these extra-functional properties. We will develop a resource aware framework providing predictable timing and resource usage of embedded software. Our overall goal is to develop hierarchical scheduling techniques into a cost efficient approach applicable for a wide range of applications, including automotive, automation, aerospace and consumer electronics. The challenge is to guarantee extra-functional properties stretching from one node to another node over the network.

**PROGRESS**

**Leader:** Hans Hansson  
**Members:** Andreas Ermedahl, Andreas Hjerström, Aneta Vulgarakis, Björn Lisper, Christer Norström, Cristina Seceleauru, Dag Nyström, Damir Isovic, Farhang Nemati, Hans Hansson, Huseyn Aysan, Ivica Crnkovic, Jagadish Suryadevara, Jan Carlson, Johan Fredriksso, Johan Kraft, Jukka MakTurja, Kristina Lundqvist, Marcelo Santos, Mikael Sjödin, Moris Behnam, Paul Pettersson, Radu Dobrin, Rafia Inam, Rikard Land, Sasikumar Punnekkat, Séverine Sentilles, Stefan Björnander, Stefan Bygde, Thomas Nolte, Yue Lu, Gunnar Widforss  
**Start date:** 2006  
**End date:** 2011  

**Funding:** Swedish Foundation for Strategic Research (SSF)
PROGRESS is a Swedish national strategic research centre at Mälardalen University in Västerås. PROGRESS is dedicated to find methods for cost-efficient handling of the increasing complexity of embedded software used in computer-based products. Our focus is on the domains of automation, ground vehicles and telecom; domains of great strategic importance for Swedish economy, and for which the majority of innovation and added value stem from software. Alas, these are also domains where the cost of software is rampaging, and where the necessary quality of software is becoming increasingly difficult to achieve.

Adopting a software-component approach to engineering and re-engineering of embedded software systems, PROGRESS provides theories, methods, and tools that increase quality and reduce life-cycle costs.

PROGRESS is focusing its research on development, adaptation and extension of Component Based Development (CBD) into a mature engineering discipline for cost-efficient development of embedded software. Based on a common vision and concept, the PROGRESS research is organized into a set of interrelated disciplinary research directions, interlinked via cross-cutting and integrating tool environment and demonstrator projects. The cross-cutting projects are important vehicles for integration of disciplinary research results and provide means for evaluation and verification of the developed technology.

PROGRESS’ vision is to be a worldwide-recognized centre in software engineering of embedded real-time systems with extensive contacts/exchange with other leading universities and to be the preferred partner for the industry. Research includes theories, methods, and tools for

- predictable embedded software development from software components and legacy code,
- interfacing components with the underlying platform and synthesising platforms from application requirements, and
- adopting and applying real-time modelling and analysis techniques across all stages of the component-based design and development chain.

**PROGRESS sub projects:**

- PG-CBD-CVer – Component Verification. Leader: Paul Pettersson
- PG-CBD-IDE – Integration Development Environment. Leader: Ivica Crnkovic
- PG-CBD-Proc – Identification and specification of CB process. Leader: Ivica Crnkovic, Rikard Land
- PG-CBD-Trans – Transformation of processes. Leader: Ivica Crnkovic, Rikard Land
- PG-Demo-Evolution – Progress Component Models. Leader: Mikael Åkerholm
- PG-Demo-Leg – Legacy demonstrator. Leader:
- PG-Demo-SAVE – The SAVE demonstrator. Leader: Thomas Nolte, Dag Nystöm
- PG-Dep-FRAMES – Faults and Reliability Aware Methodologies for Efficient Scheduling. Leader: Radu Dobrin
- PG-Dep-Pearls – Parameterized Evaluation of Attributes of Reliable Systems. Leader: Sasikumar Punnekkat
- PG-Dep-Remap – Reliability Modeling and Analysis for Predictability Assurance. Leader:
- PG-Leg-Asis – Legacy Model Analysis. Leader: Christer Norström
- PG-Leg-Comp – Composition of legacy systems. Leader: Christer Norström
- PG-Leg-Extract – Model Extraction for Legacy Systems. Leader: Christer Norström
- PG-Pla-Inc – Information Centric development of component-based embedded real-time systems. Leader: Dag Nystöm
- PG-Pla-Osc – Optimization, Synthesis and Configuration. Leader: Mikael Sjödin
- PG-Pla-Ssi – SubSystem Integration. Leader: Thomas Nolte

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**Q-ImPreSS - Quality Impact Prediction for Evolving Service-oriented Software**

**Leader:** Ivica Crnkovic  
**Members:** Ivica Crnkovic, Paul Pettersson, Cristina Secceleanu, Aida Causevic, Johan Kraft, Christer Norström, Anders Wall  
**Research group:** Industrial Software Engineering group  
**Start:** 2008-01-01  
**End:** 2010-12-31  
**Partners:**  
- Research Center for Information Technology (FZI) in Karlsruhe Germany  
- The Software Engineering Group at Politecnico di Milano  
- Distributed Systems Research Group at Charles University, Prague  
- ABB Corporate Research Centre, Germany  
- Ericsson Nikola Tesla, Croatia,  
- Itemis GmbH, Germany  
- Softeco Sismat S.p.A, Italy  

**Funding:** EU FP7  
The Q-ImPreSS project is a medium-sized focused research project (STREP) funded under the European Union’s Seventh Framework Programme (FP7), within the ICT Service and Software Architectures, Infrastructures and Engineering priority. The Q-ImPreSS project is set to run for three years and aims to bring service orientation to critical application domains, such as industrial production control, telecommunication and critical enterprise applications, where guaranteed end-to-end quality of service is particularly important.
**RAP - Robotics, Automation and Process Control**

**Leader:** Mats Björkman  
**Members:** Mats Björkman, Johan Åkerberg  
**Research group:** Wireless communication  
**Start:** 2008-07-01  
**End:** 2011-12-31  
**Partners:** ABB, Örebro University, and others  
**Funding:** KKS  
RAP is an industrial PhD school, led by Örebro university. MDHs project within RAP deals with safety and security in wireless automation networks.

**Safety-Critical Component-Based Systems**

**Leader:** Ivica Crnkovic  
**Members:** Ivica Crnkovic, Rikard Land, Mikael Åkerholm  
**External:** Christian Strzyz (CC Systems)  
**Research group:** Industrial Software Engineering group  
**Start:** 2009-05-01  
**End:** 2011-06-01  
**Partner:** CrossControl  
**Funding:** KKS  
Through new standards and stricter legislation, companies developing safety-critical products have to meet stronger requirements regarding functional safety. Still, development and manufacturing of the products must be cost efficient. The project intends to study practices which enable reuse of existing software components during product development in order to improve the efficiency, while also meeting the requirements on the integrity of the system and functions, as well as the requirements on e.g. documentation and traceability. The goal is to suggest and study methods and practices, instructions, forms of documentation, and technology which supports that the work performed during one development project gives a higher confidence when system parts are reused. By this, the effort to certify a new system with the reused component can presumably be significantly lower. We believe this also means that technologies need to be adapted so that components can be executed side by side in a predictable and trustworthy manner. An important part of the project is the active contact with Swedish industry in order to understand what are the most important requirements and limitations met in practice.

**SAVE-IT**

**Leader:** Hans Hansson  
**Members:** Hans Hansson, Andreas Ermedahl, Paul Pettersson, Gunnar Widforss  
**Start:** 2004-01-01  
**End:** 2011-10-31  
**Partners:** Linköping University, KTH, Uppsala University  
**Funding:** KK-Foundation  
SAVE-IT is an industrial graduate school with a research focus upon real-time- and safety-critical systems, and with a special focus upon component-based development of such systems. SAVE-IT organizes research studies for a number of industrial PhD students, and works for an increased cooperation and exchange between participating companies and universities. PhD students accepted to SAVE-IT are offered financial support, and are allowed to freely participate in a collection of tailor-made network activities and graduate courses. SAVE-IT is supported by the KK-foundation as part of an effort to enhance competence in Swedish industry. SAVE-IT has its organisational location at Mälardalen Real-Time research Center (MRTC) at Mälardalen University in Västerås, Sweden. SAVE-IT includes a network of industrial and academic partners. SAVE-IT also has some appointed staff (coordinator, administrator, etc.) and a controlling board.

**SISTER - Strengthening the IST Research Capacity of Sofia University**

**Leader:** Ivica Crnkovic  
**Members:** Ivica Crnkovic  
**Research group:** Industrial Software Engineering group  
**Start:** 2008-02-01  
**End:** 2010-02-01  
**Partners:** Sofia University  
**Funding:** EU  
The main goal of the SISTER project is to develop FMI as a Leading Centre in SEE in research, innovation and training in the area of ICT and more specifically in Software and Services, and Intelligent Content and Semantics. An overall goal of the project is to foster the integration of FMI in the ICT ERA and to contribute to competitiveness and growth of the SEE region and Europe as a whole.

**SOFAR - Software Architecture Evolution**

**Leader:** Ivica Crnkovic  
**Members:** Ivica Crnkovic, Hongyu Pei-Breivold, Magnus Larsson  
**Research group:** Industrial Software Engineering group  
**Start:** 2007-01-01  
**Partners:** ABB  
**Funding:** KKS, ABB  
Most of the software intensive systems nowadays become more and more complex due to the constantly incoming new requirements and evolution of technologies. The ability to develop, maintain and evolve software systems to meet quality requirements has become critical. This research project focuses on modelling of a software system from the architecture perspective in order to maintain or improve system quality attributes during the system evolution. The systems that are analysed belong to a category of complex industrial embedded systems. The project is in particular focused on particular quality attributes related to maintainability, portability, and evolution. Model-based and component-based approaches are utilised.
**START - Stochastic Real-Time Analysis of Embedded Software Systems**

**Leader:** Thomas Nolte  
**Members:** Thomas Nolte, Yue Lu  
**Research group:** Complex Real-Time Embedded Systems  
**Start date:** 2011-01-01  
**Funding:** VR, Vetenskapsrådet  

The real-time research community has over the years developed mature results in the area of real-time scheduling and timing analysis of embedded software systems. In parallel, engineers have created, developed, and evolved embedded software systems without complying with the academic real-time models required to do timing analysis. This gap between academic models and industrial practice is a key challenge in applying the (often very restrictive) academic models to real systems. The aim of this project is to develop new models that, by using statistical inference techniques, are better suited for development of real industrial systems. Given these more expressive models, we will research and develop stochastic and simulation-based analysis of embedded software systems, providing software engineers with probabilistic measures of timing requirement violations for embedded software systems, in contrast to the more traditional and coarse grained pass/fail result provided by the conventional academic worst-case real-time analysis. The developed analysis will provide an important foundation for a broader adoption of sound timing analysis techniques for complex embedded software systems with real-time requirements.

**TESLA - Time-critical & Safe wireless Automation communication**

**Leader:** Mats Björkman  
**Members:** Mats Björkman, Maria Lindén, Mikael Ekström, Marcus Bergblomma, Martin Ekström, Johan Åkerberg  
**Research group:** Wireless Communication  
**Start:** 2010-01-01  
**End:** 2012-12-31  
**Partners:** ABB Corporate Research VG Power AB DELTA AB  
**Funding:** VINNOVA  

The project aims at providing guarantees for safety and security in electromagnetically disturbed environment.

**SWELL**

**Leader:** Daniel Sundmark  
**Members:** Daniel Sundmark, Adnan Causevic, Stefan Björnander, Andreas Johnsen  
**Research group:** Software Testing Laboratory  
**Keywords:** Research school, testing, verification, validation  
**Start:** 2008  
**End:** 2012  
**Partners:** BTH, Lund, Chalmers, MDH, ABB, Ericsson, Saab, Swedish Association for Software Testing, Volvo, Sogeti, logica, Spidexa, Qtema, SauerDanfoss, ST Ericsson  
**Funding:** VINNOVA and industrial partners  

SWELL is the Swedish research school in Verification and Validation. SWELL is doing research and innovation in testing and software quality methods together with Swedish software companies. The school started in 2008 and currently have 15 PhD students, 4 universities, and 10 companies and organisations directly supporting and participating. SWELL is supported by a grant from VINNOVA and co-sponsored by the participating universities and companies.

**TIMMO-2-USE**

**Leader:** Björn Lisper  
**Members:** Björn Lisper  
**Research group:** Programming Language  
**Start:** 2010-10-01  
**End:** 2012-09-30  
**Funding:** VINNOVA  

TIMMO-2-USE aims at increasing the efficiency and accuracy in handling timing-related issues in the complex development of automotive real-time embedded systems. TIMMO-2-USE stands for TIMing MOdel - TOols, algorithms, languages, methodology, and USE cases which summarizes the main objectives of the project, i.e., the development of novel tools, algorithms, languages, and a methodology validated by use cases. TIMMO-2-USE is an ITEA2 project (ITEA 2 project 09033) with 17 partners from France, Germany, and Sweden. The project started in October 2010 and has a duration of 2 years. The project is funded by the national agencies of France, Germany and Sweden.
Network-based electronic systems in today’s vehicles are of big and increasing complexity. Mastering different types of timing constraints and behaviour in the AUTOSAR-based supply chain of the complex development process is of crucial importance when designing distributed real-time automotive systems. On the one hand this requires an adequate transition of timing information in the complete development process throughout the different abstraction levels. On the other hand, an efficient exchange of timing information is necessary between different tools and between different roles in the overall tool and supply chain, e.g., between OEM and Tier-1 suppliers. TIMMO-2-USE will address the specification, transition and exchange of different types of timing information throughout different steps of the development process. The general goal is to evaluate and enhance standards for different applications in the development by different technical use cases covering multiple abstraction levels and tools. For this, TIMMO-2-USE will bring the AUTOSAR standard and EASTADL2 into different applications like WCET analysis and in-the-loop scenarios. This will bring new algorithms and tools for the transition and conversion of timing information between different tools and abstraction level based on a new advanced methodology which, in turn, will be based on a combination of the TIMMO and the ATESST2 methodologies.

TiPCES - Timing Predictions of Complex Embedded Systems

**Leader:** Jukka Mäki-Turja  
**Members:** Jukka Mäki-Turja  
**Research group:** Model-Based Engineering of Embedded Systems  
**Start date:** 20110301  
**End date:** 20160228  
**Partners:** Arcticus Systems AB  
**Funding:** The Swedish Research Council (Vetenskapsrådet)  

Embedded systems (ES) can be found everywhere; in vehicles, robots, medical appliances, etc. Software reliability of these systems is paramount. The trend of these systems is to incorporate more and more complex functionality. Timing behavior is usually addressed during the final phases of the development process, resulting in long and costly design iterations. This research will focus on extending academic theories, specifically response-time analysis (RTA), for timing predictions of ES. RTA theory is a mature technology from a scientific viewpoint. However, the industrial impact of these theories has been limited and unsuccessful. This project will investigate, through studies on actual systems, how RTA can be extended to incorporate information of the behavior of actual systems in order to improve the accuracy of RTA. Our preliminary research has already identified some of the problems to be addressed. Furthermore, we will investigate how to encapsulate this theory into tools, so it can be incorporated into development tool chains. With such tools, timing flaws can be discovered early in the design process, reducing development costs significantly. RTA also provides formal evidence of correctness, an important aspect in certification processes. This research proposal has been identified in cooperation with several industrial partners. Thus, besides providing new scientific real-time theories, they will have a good chance of being accepted and adopted by industry.

Worst-Case Execution Time Analysis of Parallel Systems

**Leader:** Björn Lisper  
**Members:** Björn Lisper, Andreas Gustavsson, Andreas Ermedahl, Jan Gustafsson  
**Research group:** Programming Language  
**Start:** 2009-01-01  
**End:** 2011-12-31  
**Funding:** VR  

Worst-Case Execution Time (WCET) analysis finds safe upper bounds for the execution time of code fragments. Reliable WCET estimates are essential in the development of safety-critical hard real-time systems, where failures to meet deadlines can have catastrophic consequences. This project targets WCET analysis of parallel systems. Compared to WCET analysis of sequential processors, research in WCET analysis for parallel systems is almost non-existent. In the light of the current hardware revolution, where multicore processors rapidly are becoming standard, this is a glaring omission. In a few years also hard real-time applications will run on multicores, and then current WCET analysis methods and tools will become obsolete. The goal of the project is to find suitable models and methods for WCET analysis of parallel systems. The emphasis is on basic models taking parallelism into account, mainly for flow analysis and calculation. We aim to produce seminal results of the same dignity as the original works on timing schemas and IPET for sequential programs.
Projects starting in 2011

**ATAC - Advanced Test Automation for Complex Software-Intensive System**

**Leader:** Paul Pettersson, Daniel Sundmark  
**Members:** Paul Pettersson, Daniel Sundmark, Sigrid Eldh, Markus Bohlin  
**Research group:** Software Testing Laboratory  
**Start:** 2011-07-01  
**End:** 2014-06-30  
**Partners:** Bombardier, CrossControl, Ericsson, MDH, SiCS + partners of other European countries incl. Finland, Belgium, etc.  
**Funding:** Vinnova (ITEA2)  
ATAC is a project which aims at developing, enhancing, and deploying high performance methods and tools for quality assurance of large and distributed software-intensive systems.

**CONTESSE - Contract-Based Components for Embedded Software**

**Leader:** Ivica Crnkovic  
**Members:** Ivica Crnkovic, Jan Carlson, Radu Dobrin, Björn Lisper, Paul Pettersson, Sasikumar Punnekkat, Heinz Schmidt, Abhilash Thekkilakattil, Juraj Feljan  
**Start date:** 2011-01-01  
**End date:** 2014-12-31  
**Funding:** Swedish Research Council (VR)  
Embedded systems make the vast majority of computer systems today. The complexity of software in these systems is growing exponentially. Sound approaches to manage complexity is to use component-based and model-based approach. The aim of the project is to advance state of the art in component- and model-based software development for embedded systems by improving prerequisites for efficient reuse of components. This will be done by introduction of component contracts that define the conditions required by components and provided output. In the existing approaches component contracts specify functional pre- and postconditions of components. Contesse will manage contracts that also include non-functional properties. This will be done through providing formal specification of components contracts, mechanisms for instantiation and verification of the contracts in different contexts, then developing a reasoning framework for contract compositions, providing input to the contract specification from components code analysis, and system level analysis based on contracts that ensure system characteristics required. The work will be based on the previous results of the project members: formal analysis and verification, priced timed automata and modelling embedded resources, component models developed, execution time and other resources estimation based on static analysis, compositions of non-functional properties, and building run-time mechanisms to ensure the system quality.

**ITS-EASY**

**Leader:** Ivica Crnkovic  
**Members:** Ivica Crnkovic, Kristina Lundkvist, Stig Larsson, Andreas Ermedahl, Malin Rosqvist, Gunnar Widforss  
**Research group:** Software Engineering  
**Start:** 2011  
**End:** 2017  
**Funding:** KKS  
ITS-EASY is the new post graduate school within embedded systems. The project is starting up in the spring of 2011 with recruitment of 15 PhD students for employment at MDH or at one of the participating companies. ITS-EASY is funded by KKS and the 9 participating companies and has a budget of total 93.6 MSEK.

**MBAT - Combined Model-based Analysis and Testing**

**Leader:** Paul Pettersson, Cristina Seceleanu  
**Members:** Paul Pettersson, Cristina Seceleanu  
**Research group:** Software Testing Laboratory  
**Start:** 2011-06-01  
**End:** 2014-05-31  
**Partners:** Swedish partners are ENEA, KTH, MDH, Prover, and Volvo Technology. The project is lead by Daimler, Germany.  
**Funding:** ARTEMIS and Vinnova  
MBAT will provide Europe with a new leading-edge Reference Technology Platform for effective and cost-reducing validation and verification, focussing primarily on transportation domain, but also to be used in further domains. Developed by European industrial key players (large companies and SMEs) in this domain and supported by leading research partners, this MBAT RTP will be of high value for the European industry, providing very effective means to assure utmost quality embedded systems at reduced costs. With this, MBAT will also strongly support the EU vision of zero traffic fatalities by 2020. As this project is clearly industrial-driven it will be assured that the MBAT RTP will provide solutions for real-life development challenges existing in the European industry as this is also the goal of ARTEMIS projects.
pSafeCer
Leader: Hans Hansson
Members: Hans Hansson, Sasikumar Punnekkat
Research group: Real-Time Systems Design
Start: 2011
End: 2013
Partners: Volvo Technology, CrossControl (in total 23 partners in 6 countries)
Funding: Artemis, Vinnova
The objective of pSafeCer is to increase efficiency and reuse in development and certification of safety-relevant embedded systems by
• providing process and technology that enable composable qualification and certification of systems/subsystems
• reuse of already established arguments for and properties of their parts.
pSafeCer not only addresses the major areas of transport but also addresses guidelines to adapt for other or new domains easily (extends considerably market impact, applicability of results).
Multiple tools of varying capability are being used by the industrial partners. Making use of the existing tools efficiently for certification purposes will be our focus. SafeCer will provide an infrastructure – a certification tool framework interacting with the design tools to acquire the modeling artifacts, the V&V tools to obtain safety reports, and to track the certification and produce certification reports. It will include a user interface to support the user interaction with the certification process.

START - Stochastic Real-Time Analysis of Embedded Software Systems
Leader: Thomas Nolte
Members: Thomas Nolte, Yue Lu
Research group: Complex Real-Time Embedded Systems
Start: 2011
End: 2015
Funding: VR, Vetenskapsrådet
The real-time research community has over the years developed mature results in the area of real-time scheduling and timing analysis of embedded software systems. In parallel, engineers have created, developed, and evolved embedded software systems without complying with the academic real-time models required to do timing analysis. This gap between academic models and industrial practice is a key challenge in applying the (often very restrictive) academic models to real systems. The aim of this project is to develop new models that, by using statistical inference techniques, are better suited for development of real industrial systems. Given these more expressive models, we will research and develop stochastic and simulation-based analysis of embedded software systems, providing software engineers with probabilistic measures of timing requirement violations for embedded software systems, in contrast to the more traditional and coarse grained pass/fail result provided by the conventional academic worst-case real-time analysis. The developed analysis will provide an important foundation for a broader adoption of sound timing analysis techniques for complex embedded software systems with real-time requirements.

SYNOPSIS
Leader: Hans Hansson
Members: Hans Hansson, Kristina Lundkvist, Sasikumar Punnekkat, Björn Lisper
Research group: Real-Time Systems Design
Start: 2011
End: 2015
Funding: SSF, Swedish Foundation for Strategic Research
SYNOPSIS is a new large framework grant from the Swedish Foundation for Strategic Research (SSF) of 18 MSEK. The research within SYNOPSIS aims at increased efficiency and shortened “time-to-market” through compositional certification by safety critical embedded systems. SYNOPSIS mainly addresses the areas heavy vehicles, construction equipment, aero and train.

TiPCES - Timing Predictions of Complex Embedded Systems
Leader: Jukka Mäki-Turja
Members: Jukka Mäki-Turja
Research group: Model-Based Engineering of Embedded Systems
Start: 20110301
End: 20160228
Partners: Arcticus Systems AB
Funding: The Swedish Research Council (Vetenskapsrådet)
Embedded systems (ES) can be found everywhere: in vehicles, robots, medical appliances, etc. Software reliability of these systems is paramount. The trend of these systems is to incorporate more and more complex functionality. Timing behavior is usually addressed during the final phases of the development process, resulting in long and costly design iterations. This research will focus on extending academic theories, specifically response-time analysis (RTA), for timing predictions of ES. RTA theory is a mature technology from a scientific viewpoint. However, the industrial impact of these theories has been limited and unsuccessful. This project will investigate, through studies on actual systems, how RTA can be extended to incorporate information of the behavior of actual systems in order to improve the accuracy of RTA. Our preliminary research has already identified some of the problems to be addressed. Furthermore, we will investigate how to encapsulate this theory into tools, so it can be incorporated into development tool chains. With such tools, timing flaws can be discovered early in the design process, reducing development costs significantly. RTA also provides formal evidence of correctness, an important aspect in certification processes. This research proposal has been identified in cooperation with several industrial partners. Thus, besides providing new scientific real-time theories, they will have a good chance of being accepted and adopted by industry.
Staff at MRTC

Jakob Axelsson received an M.Sc. from Linköping University in 1993, and a PhD in 1997 for a thesis on hardware/software codesign of real-time systems. He has been working at ABB Corporate Research and ABB Power Generation (now Alstom) in Baden, Switzerland, Volvo Technological Development (now Volvo Technology), Carlstedt Research & Technology, and Volvo Car Corporation, all in Göteborg, Sweden. He is currently with the Swedish Institute of Computer Science (SICS) in Stockholm, where he is director of software and systems engineering research. He is also professor in software and systems engineering at Mälardalen University in Västerås, where he is leading the research group Business-oriented Engineering of Software-Intensive Systems (BESS).

Hüseyin Aysan is a PhD student at Mälardalen University since autumn, 2006. He received his B.Sc. degree in Computer Engineering from Istanbul Technical University in 2004, and his M.Sc degree in Robotics from Mälardalen University in 2006. In the first half of 2006, he worked as a research engineer in Robotics at Mälardalen University. His research interests include dependable software engineering, development of run-time fault-tolerance techniques - particularly redundancy techniques - , fault-tolerant real-time scheduling and design-time dependability analysis of dependable real-time embedded systems built using component-based development approach. He is a part of the PROGRESS National Strategic Research Centre and Mälardalen Real-Time Research Centre.

Moris Behnam has awarded a B.Eng., and M.Sc. in computer and control engineering at the University of Technology, Iraq, and also M.Sc., Licentiate, and PhD in Real time system at MDH in 1995, 1998, 2005, 2008 and 2010 respectively. Moris has been a visiting researcher at Wayne State University, USA in 2009. His research interests include real-time hierarchical scheduling, synchronization protocols, multiprocessor/multicore systems, and real time control systems.

Stefan Björnander is a PhD student working under the supervision of Professor Paul Pettersson. He holds a Master of Engineering in computer science at Umeå University. He was a visiting student at the Swinburne University of Technology during the winter of 2008/09. He is a member of the Formal Modelling and Analysis of Embedded Systems research group and his research interests include formal verification of software architecture. He has developed a model checker for the Architecture Analysis and Design Language (AADL) that evaluates properties defined in the Computation Tree Logic (CTL). He has also looked into timing annotations of AADL and developed a translator from AADL to the Timed Abstract State Machine (TASM).
Etienne did his PhD at TelecomParisTech, a French engineering school, in collaboration with Thales, an industrial group specialized in defence, security, and aeronautics systems. His contribution is a component-based design methodology for safety-critical and adaptative real-time and embedded systems. It has been implemented in an open source component-based framework that generates most of the system’s technical code (including adaptation mechanisms). Etienne’s research interests include component-based software engineering, code generation, formal verification and fault-tolerance.

Dr. Tomas Bures is an assistant professor at the Department of Software Engineering of Charles University Prague. He received his PhD degree in 2006 also from Charles University. In the meantime, he held a 1 year postdoctoral researcher position at Mälardalen University, Sweden. His research interests include component-based development (especially in resource-constrained and real-time environments), software connectors and generative programming.

Stefan is a PhD student working with parametric Worst-Case Execution Time analysis since fall 2006. He has an MSc degree in computer science from Mälardalen University, received in 2006.

Dr. Jan Carlson is a researcher at MRTC. He received his M.Sc. degree in Computer Science from Linköping University in 2000, and his PhD from Mälardalen University in 2007. Research interests include component models for embedded systems, event pattern detection, formal methods and functional and logic programming languages.

Adnan Causevic is enrolled as a PhD student at Mälardalen University in February 2008. He is member of the Dependability group within the Software Engineering Laboratory at Mälardalen Real-Time Research Centre (MRTC). He graduated at the Sarajevo University, Faculty of Electrical Engineering, Computer Science and Informatics Department in 2006. His main research interests are software testing, validation and verification mainly in agile software development process.
Ivica Crnkovic is a professor of industrial software engineering at Mälardalen University where he is the leader of the software engineering laboratory and the scientific leader of the industrial software engineering research. His research interests include component-based software engineering, software architecture, software configuration management, software development environments and tools. From 1985 to 1998, Ivica Crnkovic worked at ABB, Sweden, where he was responsible for software development. He was a project leader and manager of a group developing software configuration management systems and other software development environment tools and methods for distributed development and maintenance of real-time systems. From 1980 to 1984, he worked for the Koncar company in Zagreb, Croatia. M.Sc. in electrical engineering in 1979, M.Sc. in theoretical physics in 1984, and PhD in computer science in 1991, all from the University of Zagreb, Croatia.
Dr. Radu Dobrin started his PhD studies in Computer Science at Mälardalen University in 2000 and finished it in 2005. His research was mainly performed in the area of off-line and online scheduled safety critical, real-time applications. Currently, his research is focused in the area of dependable embedded real-time systems build using component based development within the PROGRESS project.

Gordana Dodig Crnkovic is an Associate Professor in Computer Science. Her research is in Computing and Philosophy, Foundations of Information Science and Theory of Science. She teaches courses in those subjects on graduate and undergraduate level. She has written a book Information and Computation Nets in 2009 and published two edited volumes: Information, Computation, Cognition with Susan Stuart in 2007 and Information and Computation with Mark Burgin, forthcoming in 2010. She is a scientific committee member of the International Science of Information Institute, steering committee member of European Computing and Philosophy Organization, Member of the Editorial Board of the World Scientific Series in Information Studies and Member of the Editorial Board of the journal Information.

Sigrid Eldh is working as a researcher at Ericsson, serving in different positions across the company for many years. She has a Licentiate degree from Mälardalen University, a Masters in Computer Science from Uppsala University and a Diploma in Gestalt Therapy. In addition, she has a variety of studies in leadership, pedagogy, sociology and economics. She has published a book on Operating and Computer Systems. Her main interest is all aspects of software quality, process and improvements, with a main focus on software testing, verification and validation. She is a frequent speaker at international conferences, and teaches courses in those subjects. She has been a co-founder and of several associations in the software testing field, such as SAST, ASTA, ISTQB and SSTB and serves as a member of several program committees.

Andreas Ermedahl is an associate professor at Mälardalen University since 2008. Andreas received his PhD in 2003 at Uppsala University.

Juraj Feljan is a PhD student at Mälardalen University and at the Faculty of Electrical Engineering and Computing (FER), University of Zagreb, Croatia. He received his M.Sc. degree in Computer Science at FER in 2008. His research domain is component-based software engineering for embedded systems, with the focus on extra-functional properties. He is involved in two projects - PROGRESS and DICES.
Dr. Johan Fredriksson was awarded a M.Sc., Licentiate, and PhD degree in Computer Engineering in 2003, 2005 and 2008, respectively. He was a Visiting Researcher at Monash University of Melbourne during 2005, and was an industrial PhD student at the company Cross-Country Systems between 2006 and 2008. Johan is currently employed with the company ENEA, and funded by the knowledge foundation (KKS) for continued research with MDH. His research is carried out at the PROGRESS centre and in collaboration with ENEA. Johan’s research interests include component-based development, predictable execution of embedded systems, multi-core systems and distributed embedded real-time systems.

Daniel Flemström has been working at Mälardalen University since 2000. He received his M.Sc. from Mälardalen University in 1995. He is responsible for the Industrial Research and Innovation Lab, which is a top-talent initiative together with Ericsson AB and ABB AB. He is also teaching courses in Industrial System Development. His research interests include usage of Linux in embedded devices and issues when developing complex telecom applications.

Fredriksson, Johan

Barbara Gallina is a Post-Doc Researcher within the Dependability group at MRTC. Currently, she is involved in the European Project ARTEMIS-JU100022 CHESS, within which she investigates techniques to analyze and guarantee the dependability of high-integrity embedded systems. She got a M.Sc. in Computer Engineering in 2003 and a II-level Master in IT in 2004, both from Politecnico di Milano, Milan, Italy. She got her PhD in Computer Science in 2010 from the University of Luxembourg, Luxembourg, Luxembourg. Her research interests include dependability, transaction models, reuse-based methods for software engineering and failure behavior analysis of component-based systems.

Joakim Fröberg is an Industrial PhD student employed at Volvo Construction Equipment Components AB where he is working with electronic systems and integration issues at the department of product development/electronics. Joakim is also a PhD student at the Software engineering laboratory at MKTC where he is working in the DRIVE project to study requirements and design of vehicle electronic architectures. He received his M.Sc. in Industrial Control System at Salford University 1996.

Joakim, Joakim

Barbara Gallina, Barbara

Jan Gustafsson is assistant professor in computer science. He has a B.Sc. from Uppsala University in 1974, a Tech.Lic. at KTH 1994 and a PhD at Uppsala University in 2000 for a thesis on WCET (Worst Case Execution Time Analysis). Docent (habilitated) in Computer Science at Mälardalen University 2005. He was at ASEA/ABB between 1975 and 1985 with industrial control systems. Since 1985, he is at Mälardalen University. During several years in the 1990s and 2000s, he was head of the Department of Computer Science and Engineering. 2007 - 2010, he was the Dean of the Faculty of Natural Sciences and Engineering. He has been the chair of several international workshops and conferences in the area of real-time and embedded systems. Steering Group member for the international WCET Workshop.

Jan, Jan

Gustafsson, Jan
Leo Hatvani is a PhD student at MRTC. He graduated from the Faculty of Electrical Engineering in Sarajevo in January 2009. His diploma thesis was “Development of Fuzzy Inference Systems Using Fuzzy Toolbox”. He is currently involved with the research project PROGRESS hosted by Mälardalen University, and is working on extension of the UPPAAL CORA tool.

Håkan Gustavsson is an industrial PhD student. Håkan has been working with vehicle electronic systems integration and architecture since 2002 at Scania CV AB in Södertälje. He is currently employed as an Industrial PhD student within the electrical systems predevelopment section at Scania. He received his B.Sc. in Electrical Engineering at the Royal Institute of Technology 2002 after completing his studies with a final year at Fachhochschule Zentral Schweiz. His research area is systems engineering of vehicle electronics. His licentiati thesis was accepted in 2008, where a method was presented on how to improve the decisions made during the early phases of E/E-system development. His current research focus on how Lean principles can improve the process of architecting E/E-systems.

Andreas Gustavsson is a PhD student at Mälardalen University since September 2009. He previously received his M.Sc. in Automation and Mechatronics (focusing on Computer Science) from Chalmers University of Technology in December 2007. He is a member of the Programming Languages research group at Mälardalen Real-Time Research Center. His current research interest is Worst-Case Execution Time (WCET) analysis of parallel (multi-processor and threaded software) systems.

Yin Hang is a PhD student at MRTC. He studied Intelligent Embedded Systems at Mälardalen University since 2008 and got his Master Degree there in 2010. During his master study, he was ever exchanged to Eindhoven University of Technology (TU/e) in Eindhoven, the Netherlands for one semester. He started his PhD study directly after his graduation in 2010 and was engaged in the ARROWS project. His research area is Adaptive Embedded Systems and his recent focus is the mode switch logic design for component-based multi-mode systems.

Hans Hansson is professor in Computer Engineering/Real-Time Systems, at Mälardalen University since 1997, where he is director of research at the School of Innovation, Design and Engineering, director of Mälardalen Real-Time Research Centre, and director of the PROGRESS national strategic research centre. He has made scientific contributions in the areas of component-based design of real-time embedded software, modeling and analysis of real-time communication, real-time testing and debugging, execution-time analysis, development of automotive control software, and formal modeling of timing and probability.

Hatvani, Leo
Andreas is a PhD student at MRTC, and received his M.Sc. in Computer Science from Mälardalen University in 2007. He works in the area of real-time embedded systems with a special interest in data management. The research is performed within Progress with a primary focus to investigate how design-time data management and real-time database management can be integrated in the design and development of embedded real-time systems.

Rafia Inam is a PhD student at Mälardalen Real-Time Research Center, and holds a M.Sc. in Computer Science from Quaid-i-Azam University, Pakistan. Rafia has worked at Norsk Data Pvt. Ltd. in Pakistan as a Software Engineer for 2 years and then started teaching at Bhaudin Zakariya University, Pakistan. In 2007 Rafia travelled to Sweden to write her master thesis on “Networks and Distributed Systems” at Chalmers university of Technology. Her PhD studies at MRTC are focusing on Deployment and Realization of Component-Based ProCom models in a distributed real-time environment.

Assoc. Prof. Damir Isovic is a Vice Dean of School of Innovation, Design and Engineering and associate professor in computer science at MDU. He is actively involved in undergraduate teaching, and is a winner of several teaching awards, among others “Bayer Teaching Excellence” award and “Lecturer of the Year” award. Damir has been acting as head of internationalization, director of education and program coordinator at MDU. He has developed several teaching tools, including an internet-based platform for distance education. He is guest lecturer of Technical University of Eindhoven, Charles University, Prague, Royal Institute of Technology, Sweden, University of Sarajevo, Bosnia, and East China University, Shanghai. He has more than 40 research publications in international journals, conferences and books to his credit. He served various conferences and workshops as PC member.

Andreas Johnsen is a PhD student working together with Prof. Kristina Lundqvist on a project studying Architecture-based Verification of Software-Intensive Systems at Mälardalen Real-Time Research Centre. Andreas received a M.Sc. in Robotics at Mälardalen University in 2010. His M.Sc. thesis work consisted of development of a Fly-by-wire Flight Control System. In 2009, Andreas contributed to the “House on the moon” project, in cooperation with NASA, where Andreas developed a vision system, using LIDAR (Light Detection And Ranging) technology, for the lunar-rover. Andreas is currently a member of the Swedish Verification & Validation Excellence (SWELL) research school.

Dr Eun-Young Kang is Korean national. Prior to joining PROGRESS, she worked as a research fellow at United Nations University International Institute Software Technology since 2008. She received a PhD in computer science from Henri-Poincare Univ. Nancy 1, France 2007, participated in the joint PhD program between Delft University in Holland and INRIA in France. Her speciality is formal modeling, design and verification. Her research interest is combining several different formal method techniques to handle complex designs either automatically or with less manual intervention.
Holger M. Kienle holds a PhD degree from the University of Victoria, Canada (2006), a Diploma in Computer Science from the University of Stuttgart, Germany (1999), and a M.Sc in Computer Science from the University of Massachusetts Dartmouth (1995). His research interests include software reverse engineering, domain-specific languages, virtual worlds, and legal issues that impact information technology. He is program co-chair for WSE 2010 and co-organizer of the WASDeTT workshop series.

Dr. Johan Kraft is a post-doctoral researcher at the Embedded Systems department. Apart from his PhD degree, he has a Licentiate degree in Computer Science and a Magister (Master) degree in Computer Engineering, all at MDH. His past also includes a few years of embedded software development at ABB Robotics and his research has a strong industrial connection. Johan is also the founder of Percepio AB, an MDH spin-off company focusing on embedded software visualization tools. The research focus of Dr. Johan Kraft is automated analysis of embedded software, especially during maintenance of already implemented systems. This includes program analysis, simulation techniques and monitoring of embedded software systems. Johan is the thesis coordinator for the Västerås part of the School of Innovation, Design and Engineering.

Linus Källberg is a teacher in Computer Science at the School of Innovation, Design and Technology at Mälardalen University. Specifically, he teaches object-oriented programming, compiler technology, computer architecture, and computer games development. He received his M.Sc. in Computer Science from Mälardalen University in 2010. His Master’s thesis addressed the acceleration of image synthesis using hierarchical representations of geometrical data. He has also been involved in research in static source code analysis and computer graphics.

Rikard worked as software developer at ABB Atom and Westinghouse 1998-2001. In 2001 he enrolled as a PhD student at Mälardalen University, in the field of Software Engineering. His PhD thesis covered integration of in-house developed software systems and was defended in September 2006. He currently holds a senior lecturer position, teaching courses in Software Engineering, and is partially employed at CrossControl as software specialist. His research is carried out at the PROGRESS centre and in collaboration with the company CrossControl, on life-cycle processes for embedded (in particular safety-critical) software-intensive systems.

Thomas Larsson is a teacher and researcher in Computer Science. He was promoted to assistant professor in 2008 for his pedagogic skills. Currently, his research interests are real-time computer graphics algorithms, spatial data structures, intersection test methods, real-time rendering, and virtual reality. He received a bachelor and master degree in 1996 and 1999, respectively, in computer engineering. His PhD degree in computer science was completed in March, 2009.
Magnus Larsson is an adjunct professor in Computer Science at MDH and research manager at ABB Corporate Research where he is responsible for software research within ABB Sweden. He received a B.Sc. in computer engineering from Mälardalen University in 1993 and a M.Sc. in computer science from Uppsala University in 1995. Magnus achieved a PhD in computer science 2004 studying how to predict quality attributes in component-based software systems. Magnus current research interests are component-based software engineering and software architecture. During his years at ABB, Magnus participated in the development of object management facility (OMF), a distributed object oriented middleware, which was awarded the second prize in the OMG/Object Worlds competition for the best use of object technology in 1997.

Stig Larsson is a part researcher at Mälardalen University and works also as a consultant. His main research interest is software engineering, with focus on the synergies between processes and architecture. His experience includes management of company wide technology projects and management of development organizations with software and hardware development in several sites. Stig Larsson received his MSc in Electrical Engineering from the Royal Institute of Technology, Stockholm, Sweden 1983. His licentiate thesis “Improving Software Product Integration” was presented in June 2005. His PhD thesis covered “Key Elements of Software Product Integration Processes” and was defended in December 2007.

Luka Lednicki is a PhD student at the Faculty of Electrical Engineering and Computing (FER), Zagreb, and Mälardalen University, Västerås. He received his M.Sc. degree in computer science at FER in 2008. Currently he is involved in research.

Thomas Leveque did his PhD at Grenoble University, in collaboration with ST Microelectronics. His PhD results about model versioning have been incorporated in CADSE open source project. He received his M.Sc. in Computer Science from Grenoble University in 2005. He has worked in the following companies: Sun Microsystems, InfoVista and France Telecom. Thomas made scientific contributions in the area of Model-Driven Engineering, Component-Based Software Architecture and dynamic adaption of human computer interfaces. His main research area is focused on model versioning and Model-Driven Development. His research interests also include Dynamic Service-Oriented Architecture. Thomas joined MRTC as a postdoctoral research fellow in 2010. He is involved in the design of the ProCom IDE.

Björn Lisper is professor in Computer Engineering at Mälardalen University since 1999, where he leads the Programming Languages research group. He received his MSc (Engineering Physics) 1980, and Doctor of Technology (Computer Science) 1987, both from KTH, Sweden, where he also was appointed “docent” in Computer Systems (1991). He is a member of the board of the Vinnova-supported CNS competence center at SICS. Prof. Lisper is the coordinator of the Marie Curie IAPP project APARTS, and he is Core Member of the FP7 NoE ArtistDesign where he leads the timing analysis activity. He is also a member of IFIP WG 10.2 on Embedded Systems.
Yue Lu has a licentiate degree in embedded systems. He received a M.Sc in Mechatronics from University of Southern Denmark, 2005, and he worked in Sony Ericsson BMC (Beijing) as a test developer, 2006. His expertise lies in using statistics and probability theory in timing analysis and performance assessment of complex industrial real-time embedded systems, as well as simulation optimization, model checking, model-driven engineering, etc. He has authored 21 publications in total. Among these, he has been the first author of a licentiate thesis and 18 peer-reviewed papers. He also won several grants and scholarships including Lars Magnus Ericsson grants for year 2011, French INRIA scholarship 2011, ARTES mobility support, etc. He is a member of IEEE, ACM, SIGAPP and SNART.

Kristina Lundqvist is professor of Dependable Software Engineering at Mälardalen University since 2007. Prior to her return to Sweden, she served as an assistant professor in the Department of Aeronautics and Astronautics at the Massachusetts Institute of Technology (Cambridge, MA), where she founded and directed the Embedded Systems Laboratory between 2002 and 2007. Prof. Lundqvist received her PhD in Computer Systems at Uppsala University, where she focused on real-time operating system design. Her current research interests are fairly distributed between developing tool-supported frameworks for lifecycle aspects of mission critical systems development and sustainment, and addressing people and organizational issues associated with software development.

Frank Lüders is senior lecturer in software engineering at the School of Innovation, Design and Engineering at Mälardalen University. He received a B.Sc. in electronics engineering from Vestfold College, Norway in 1993, an M.Sc. in electrical engineering/computer systems from the Technical University of Denmark in 1997, and a PhD in computer science and engineering from Mälardalen University in 2006. Frank worked with software development at ABB A/S in Norway until 1999 and at ABB Automation Technologies AB in Sweden until 2003. His research interests include component-based and model-driven development/engineering of industrial software and systems. The research is mainly conducted using empirical methods such as case studies, experiments, and surveys.

Josip Maras is a PhD student at Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB), Split, Croatia, and Mälardalen University. He graduated at FESB in January, 2009, and received M.Sc. degree in computer science. Josip is involved in two research projects; PROGRESS hosted by Mälardalen University and DICES hosted by FESB. The focus of his thesis is componentization of distributed embedded systems, with emphasis on service-oriented and web-based systems.

Saad Mubeen is a PhD student at MRTC, Mälardalen University. He holds a B.Sc. in Electrical Engineering with a major in Communication from NWFP University of Engineering and Technology, Pakistan, 2006. Then followed a move to Sweden and a M.Sc. in Electrical Engineering specialization in Embedded Systems from Jonkoping University, 2009. His research focus is on “Execution Modeling in Distributed Real-Time Systems” for automotive embedded systems. Other areas of interest are Network on Chip and Wireless Sensor Networks.
Mäki-Turja, Jukka

Dr. Jukka Mäki-Turja is a senior lecturer at Mälardalen University. He received his PhD in Computer Science from Mälardalen University, Sweden (2005). The current research goal is to find theories, methods and tools that will make software development cheaper, faster and yield higher quality software. More concretely the research consists of model based development of software for embedded control systems with emphasis on analysis of temporal and spatial resources. The research is often conducted with close industrial cooperation where the goal is to transfer novel research results to industry and getting new industrially relevant research questions back to academia.

Farhang is a PhD student at Mälardalen University. Farhang received his B.Sc. in Computer Engineering from University of Tehran in 1997. He worked as a software developer from 1997 till 2002. He received his M.Sc. in Computer Science from Uppsala University in 2006. His research area is Real-time systems in general, and in particular his research interests include (1) Scheduling and synchronization in multiprocessor/multi-core architectures, (2) Migrating real-time legacy systems to multiprocessor/multi-core architectures.

Nolte, Thomas

Dr. Thomas Nolte is Associate Professor at MRTC. He is Leader of the Complex Real-Time Embedded Systems research group, Program Leader of The PROGRESS Centre for Predictable Embedded Software Systems, and President of The Swedish National Real-Time Association (SNART). In 2010 he was awarded Future Research Leader by the Swedish Foundation for Strategic Research (SSF). He has published more than 115 papers in peer-reviewed fora (journals and conferences). His research interests include predictable execution of embedded systems, design, modeling and analysis of real-time systems, multicore systems, distributed embedded real-time systems. He is a very active member of the international research community, including Board Member of JSA; Guest Editor of TII; General Chair of SIES; Program Chair of ETFA, SIES and WFCS; PC-member of more than 50 program committees, including all top events in real-time systems: RTSS, ECRTS, RTAS and RTCSA, and factory automation: ETFA and WFCS.

Norström, Dag

Dr. Dag Nyström received a M.Sc. in computer science from Mälardalen University in 2000 and a PhD at Mälardalen University entitled “Data Management in Vehicle Control-Systems” in 2005. Dag founded the spin off company DNKU with the purpose of commercializing his research results in 2006. Dag is currently working 50% as researcher at Mälardalen Real-Time Research Centre within the PROGRESS project, 50% as Product Manager for Mimer SQL Real-Time Edition at Mimer Information Technology. Dags research is focusing on data management in vehicle control systems and embedded real-time systems in general. Current projects include: The INCENSE project (Sub-project under PROGRESS) and the SAVE++ project as a continuation of the SAVE project.

Dr. Dag Nyström

Dr. Dag Nyström received a M.Sc. in computer science from Mälardalen University in 2000 and a PhD at Mälardalen University entitled “Data Management in Vehicle Control-Systems” in 2005. Dag founded the spin off company DNKU with the purpose of commercializing his research results in 2006. Dag is currently working 50% as researcher at Mälardalen Real-Time Research Centre within the PROGRESS project, 50% as Product Manager for Mimer SQL Real-Time Edition at Mimer Information Technology. Dags research is focusing on data management in vehicle control systems and embedded real-time systems in general. Current projects include: The INCENSE project (Sub-project under PROGRESS) and the SAVE++ project as a continuation of the SAVE project.

Dr. Christer Norström

Christer holds a position as professor in Computer Science and Engineering at Mälardalen University since 2002. He is also managing director for SICS since February 2010. He was previously Vice President for Mälardalen University. Christer has many years experience from working in industry. His last position in industry was as Technology manager at ABB Robotics. His research interest is development of complex control systems from a business, management, processes and methods and technology perspective from an effectiveness and efficiency perspective. Christer has been working with collaboration initiatives and projects between industry and academia extensively the last 15 years. He is very interested in technology transfer from academia to industry and has manifested that through several successful transfers to the automotive industry.
Sasikumar Punnekkat is a professor in dependable software engineering at Mälardalen University and the leader of the Dependable systems research group. He has more than 15 years industrial experience as a scientist at the Indian Space research Organization, and was the Head of the Software test and reliability engineering. He was recipient of the prestigious Commonwealth Scholarship and was awarded D.Phil in Computer Science by the University of York, UK in 1997. He was a post-doctoral research fellow (1999-2000) and a senior lecturer (2004-2007) at MDH. He is the coordinator of a large EU-Asia mobility and cooperation project, EURECA, funded by the EU. He is the program director of the Master Programs in Software Engineering at MDH. His research interests include multiple aspects of Real-time Systems, Dependability, and Software Engineering.
Malin Rosqvist joined Mälardalen University in 2009 as a research coordinator at the School of Innovation, Design and Engineering. Malin specializes in running projects and activities in cooperation with the industry, as well as in PR and communication about the research at the school. Malin comes from a position as marketing manager at ABB Robotics, working globally with marketing and sales of industrial robots. Malin holds a MA from the University of Gothenburg, Sweden.

Mehrdad Saadatmand is an industrial PhD student at Mälardalen University. Mehrdad got his B.Sc. in Computer Science at Ferdowsi University of Mashhad, Iran. In 2009 he graduated as M.Sc. in Software Engineering from Mälardalen University. He has worked with the SAVE project team at MRTC as part of his master thesis. After graduation, he got employed by ENEA and also started his PhD studies in Model-Based Engineering of Real-Time Embedded Systems. He is currently involved in the CHESS project at MRTC.

Vijayalakshmi Saravanan is a PhD student at Mälardalen University. She enrolled as a PhD student at Mälardalen University under the Erasmus Mundus (EURECA) Programme as an exchange student from India. She holds a B.Sc. in Electrical and Electronics Engineering and M.Sc. Degree in Information Technology from Bharathiar University & Manonmaniam Sundaranar University (Now Anna University), India. Currently, she holds a position as assistant professor at the School of Information Technology and Engineering, VIT University, India. Her research interests include Multi-core Low Power Design Exploration, Power-Aware Processor Design, and Computer Architecture.

Heinz Schmidt is adjunct Professor of Software Engineering at Mälardalen Real-Time Research Centre.

Dr. Cristina Seceleanu is a senior researcher at Mälardalen University, Embedded Systems Division. She received a MSc. in Electronics from Polytechnic University of Bucharest, Romania, in 1993, and a PhD in Computer Science from Åbo Akademi and Turku Centre for Computer Science, Åbo, Finland, in 2005. Her research focuses on developing formal models and verification techniques for constructing predictable real-time embedded systems.
Tiberiu Seceleanu is principal scientist at ABB Corporate Research Centre in Västerås, Sweden - where he leads several projects in the area of WSN and multiprocessing design methods, and adjunct professor at Mälardalen University. Primary research areas address topics in digital hardware design, with an emphasis on multiprocessor architectures, design methodologies, hardware description languages and formal methods. Tiberiu Seceleanu got his PhD degree in computer science from Åbo Akademi in Finland (2001), and a docentship in embedded computing from University of Turku, Finland (2007). He lead the team that developed the ARTEMIS strategic research activities in the area of multiprocessing (2006/7), and coordinated the Academy of Finland project DOMES on multiprocessing architectures.

Séverine Sentilles is a PhD student at MRTC, Mälardalen University. She received a M.Sc. in Computer Science from the University of Pau (France) in 2006 and presented her licentiate thesis in 2009. She is involved in the specification of a component-based development approach for distributed embedded systems within PROGRESS and actively participates in the component model specification and in extra-functional property management. She is also responsible for leading the realization of the integrated development environment supporting the approach. She had been involved in the SAVE++ project as a member of the developing team with a specific responsibility for the design part (design of the metamodel and design tool development). Her main research interests include in CBSE and MDE.

Mikael Sjödin is professor at MRTC, focusing his research on new methods to construct software for embedded control systems in the vehicular and telecom industry. The current research goal is to find methods that will make software development cheaper, faster and yield software with higher quality. Concurrently, Mikael has also been pursuing research in analysis of real-time systems, where the goal is to find theoretical models for real-time systems that will allow their timing behavior and memory consumption to be calculated. Mikael received his PhD in computer systems 2000 from Uppsala University (Sweden). Since then he has been working in both academia and in industry with embedded systems, real-time systems, and embedded communications. In 2006 he joined the MRTC faculty as a full professor with specialty in real-time systems and vehicular software-systems.

Jayakanth “JK” Srinivasan is an Assistant Professor at MRTC. His research focuses on applying enterprise thinking to knowledge-intensive industries ranging from Aerospace & Automotive to Software Services. His book “Beyond the Lean Revolution: Achieving Successful and Sustainable Enterprise Transformation” (co-authored with Debbie Nightingale) presents transformation principles and holistic frameworks for understanding and analyzing enterprises. Dr. Srinivasan holds an undergraduate degree in computer engineering, graduate degrees in aeronautics and astronautics and avionics engineering, as well as a doctoral degree in computer science. He is a senior member of the Association of Computing Machinery.

Pia Stoll holds a Master of Science in Engineering Physics from Lund Technical University (LTH) 1997. She did two years of PhD studies in the field of Mathematical Statistics at LTH and University of Kaiserslautern, Germany. In 2000 she started to work at ABB Corporate Research in Heidelberg, Germany, and transferred to ABB Corporate Research, Västerås in 2002. 2006 she started her PhD studies again as an industrial PhD student for ABB and MDH. In October 2009 she defended her Licentiate Degree with Ipek Ozkaya from Software Engineering Institute, Pittsburgh as opponent.
Daniel Sundmark is a senior lecturer and a researcher in the Software Testing Laboratory. He received a M.Sc. degree in Information Technology from Uppsala University in 2003, a licentiate degree from Mälardalen University in 2004, and a PhD degree from Mälardalen University in 2008.

Jagadish Suryadevara received B.Sc and M.Sc (Applied Mathematics) from Andhra University, India, and M.Tech (Computer Science) from Jawaharlal Nehru Technological University. Previously he worked as a senior lecturer in ‘Computer Science and Information Systems’ group at Birla Institute of Technology and Science, India. Jagadish did early research work in the area of component specification of concurrent, reactive systems at Tata Institute of Fundamental Research (TIFR), India. His general research interests include reactive systems, formal specification and verification, software architectures, and real-time systems. Currently, Jagadish is a PhD student at MRTC.

Abhilash is a PhD student at Mälardalen University. He holds a M.Sc. in software engineering from Mälardalen University, Sweden, and a bachelor of technology degree in computer science and engineering from Amrita Vishwa Vidyapeetham, India, in 2009. He was an Erasmus Mundus scholar under the EURECA programme in 2009.

Dr. Elisabeth Uhlemann got her M.Sc. degree in computer systems engineering from Halmstad University, Halmstad, Sweden, in 1998 and her PhD degree in communications theory from Chalmers University of Technology in 2004. She currently holds a position as associate professor in Wireless Real-Time Communications at the Centre for Research on Embedded Systems (CERES), Halmstad University, Halmstad, Sweden. Her research is directed towards real-time communications, concatenated codes, incremental redundancy, cooperative relay networks, cross-layer design and vehicular communications. Visiting MRTC and ISS during two years as part of a VINNPM project.

Aneta is a PhD student within PROGRESS. She received a Licentiate degree (2009) in Computer Science at Mälardalen University, Sweden and M.Sc. degree (1006) at the Faculty of Electrical Engineering, Macedonia with professional specialization in Computer Science, Information Technology and Automation. Her main research interests are component-based software engineering, formal models and verification techniques for constructing correct and predictable real-time embedded systems. More precisely, the goal of her research is to define a PROGRESS component model suitable for development embedded systems and enriching the model with a general resource usage framework which will provide information about the resource allocation within the PROGRESS components and the composed system itself.
Anders Wall is a researcher at the Software Engineering Lab. He received his M.Sc. in computer science from Uppsala University in 1994, his Ph.Lic from Uppsala university in September 2000, and his PhD from Mälardalen University in September 2003. Anders has three years of industrial experience from software development of industrial control systems at ABB. His research interest includes design of real-time systems, software architectures, component based software engineering for real-time systems and formal methods for real-time systems. He has given courses on software engineering, data communication, and project management at Mälardalen University.

Peter Wallin holds a PhD from MDH. The title of his PhD thesis is “Software systems” (2011). He received his M.Sc in computer science from Mälardalen University 2006. His research is funded by VINNOVA and is done in cooperation with Chalmers, Volvo 3P, Volvo Car Corporation and Volvo CE. The aim of the research is to find models to support decisions made during early stages in the development of electronic architectures for vehicles.

Dr Kurt Wallnau has 20 years of experience in software research and development. He currently leads the Predictable Assembly from Certifiable Components (PACC) exploratory research project at SEI, Software Engineering Institute at Carnegie Mellon University, Pittsburgh, Pennsylvania, USA. Kurt Wallnau received his PhD from Mälardalen University in 2010.

Gunnar Widforss is the head of the division for Research Coordination at the School of Innovation, Design and Engineering. He especially supports PROGRESS and also coordinates the team of research coordinators at the academy. Gunnar Widforss joined Mälardalen University 1999 as research officer in the central administration and the division of education and research. He was responsible for research related tasks at the university board and faculty board. Coordinator for the research administration and the administrative support to the boards of faculties, Deputy head of division 2002-2004, Substitute EU Liaison officer 2002, Substitute director of postgraduate studies 2004, Substitute head of division 2004-2005. Since 2005 he was part of the department of computer science and electronics and currently the school of Innovation, Design and Engineering.

Jiale Zhou is a PhD student at Mälardalen University (MDH) since February 2011. He got a Bachelor Degree in Electronic Engineering at Shanghai Jiao Tong University (SJTU), China, in 2007. Jiale Zhou received a M.Sc. in Computer Science at MDH, in October 2010. During his master study, he stayed at Eindhoven University of Technology (TU/e), Holland, for half a year as an exchange student. His M.Sc. thesis project is “Telecom and Internet Services Mashup in Robotics - Design, Architecture and Prototyping”. He is now working at MRTC together with Prof. Kristina Lundqvist on a project focusing on Software Traceability. His research interests are now focusing on Software Verification and Validation, Software Traceability, and other related topics.
Mikael Åkerholm is an industrial researcher, he is part-time with MRTC, Software Engineering Lab, and part-time at ABB Corporate Research.

Mikael Åsberg was enrolled as a research engineer in 2008 at Mälardalen University Västerås, Sweden. He started his PhD studies the following year (2009). Mikael received a M.Sc. in both Computer Science and Computer Engineering, at Mälardalen University, 2008. Mikael has been a visiting researcher at NXP Semiconductors/Research in Eindhoven (Holland), 2008. Mikael’s research includes real-time hierarchical scheduling, synchronization protocols, execution time monitoring, scheduling in Linux/VxWorks and AUTOSAR.
Publications

Books

Journals
10. Israel Navarro (external), Nancy Leveson (MIT), Kristina Lundqvist: Semantic decoupling: reducing the impact of requirement changes, Requirements Engineering, August, 2010

Theses


**Articles in collection**

21. Gordana Dodig-Crnkovic: Biological Information and Natural Computation, Thinking Machines and the Philosophy of Computer Science, IGI Global, Editor(s): Jordi Vallverdú, 2010


**Conferences and workshops**


29. Rui Santos (University of Aveiro, Portugal), Paulo Pedreiras (University of Aveiro, Portugal), Moris Behnam, Thomas Nolte, Luis Almeida (University of Porto, Portugal): Hierarchical Server-based Traffic Scheduling in Ethernet Switches, 3rd Workshop on Compositional Theory and Technology for Real-Time Embedded Systems (CRTS’10), San Diego, CA, USA, December, 2010


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41. Rafia Inam, Daniel Cederman (Chalmers University of Technology), Philippas Tsigas (Chalmers University of Technology): A* Algorithm for Graphics Processors, THIRD SWEDISH WORKSHOP ON MULTI-CORE COMPUTING - MCC’10, Chalmers University of Technology, Sweden, November, 2010


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44. Aleksandar Dimov, Senthil Kumar Chandran, Sasikumar Punnekkat: Mutation testing framework for software reliability model analysis and reliability estimation, Central and Eastern European Software Engineering Conference (CEE-SECR), Moscow, Russia, October, 2010

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MRTC reports


Technical reports


Master theses

Computer Science

ANURADHA SURYADEVARA: Surveying and evaluating tools for managing processes for software-intensive systems
MANZOOR AHMAD: A Code Generator for Software Component Services in Smart Devices
THOMAS SÖRENSEN: Test Process Improvement & Test/Build Tool Evaluation
MUHAMMAD RAFIQUE DANISH: Component Repository Browser
ROBIN KJELLIN HADLEY: Monitoring system for free form modeling machines at Digital Mechanics
DARYAN YASSIN: Utveckling av programvara till USB I/O
FARAHNAZ YEKEH: Hierarchical server-based communication with switched Ethernet
SHAHID IQBAL TARAR: Web based sales management system
IVO PETKOV: GUI for componentbehavior - based on REMES
ERIK ÖSTROM: Building and experimentally evaluating a smart antenna for low power wireless communication
PABLO SANTIBANEZ JARA: Independent Local Locator Substrate Indirection Transport - ILLSIT
FREDRIK JANSSON: Att stärka innovation i mjukvaruföretag
HANG YIN: Adaptive Embedded Systems
CEM HIZLI: Thermal optimization of VEO+ projector

PANON SUPIRATANA: Graphical visualization and analysis tool of data entities in embedded systems engineering

ARVIND OJHA: Comparing Applicability of Test Design Techniques for Telecom systems

CHRISTIAN SELANDER: Utveckling av programvara till USB I/O

TORD KARLSSON: Enhanced Automotive Real-Time Testing Through Increased Development Process Quality

GUIDO DI CAMPLI: Comparing Test Design Techniques for Open Source Systems

JENIS KAVADIYA: Test Derivation and Reuse through Horizontal transformation of System models

SAJJAD ALI KHAN: Component Repository Browser

VIJAYA KRISHNA CHERUKURI: Model Based Testing for Non-Functional Requirements

ADNAN GÖHAR: Analyzing Service Oriented Architecture (SOA) in Open Source Products

JONAS HOLMQVIST: Enhanced Automotive Real-Time Testing Through Increased Development Process Quality

Hussan Iftikhar: Performance Testing and Analysis of Modern Web Technologies

MIKAEL SVENSSON: Independent Local Locator Substrate Indirection Transport - ILLSIT

JESPER SÖDERLUND: Test Process Improvement & Test/Build Tool Evaluation

NITISH NARAYAN: Advanced Intranet Search Engine

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SRIRAM SUNDAR RAJAN: Effectiveness of Tracing in a Multicore Environment

LINUS KARLSSON: Crack Detection in Welding Process using Acoustic Emission

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GANGADHAR CHALAPAKA: A Software Engineering Approach to Computer Networks Management

FREDRIK ERIKSSON: Porting OSE Systems to Linux

ANA GASI: Live TV Broadcasting via Mobile Devices
**Electronics**

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LUIS HERMOSA SANTOS: Research for energetic improvement of wireless sensor network based in bluetooth

MATHIAS ISAKSSON: Development of a Multi-bus platform for automation testbed

MELIKA HOZHABRI: Development of Additional Functionality: REB670 Busbar Protection

CHRISTIAN PAULSSON: Dasher the running robot

VICTOR RIVERO PINDADO: Monocular Visual SLAM based on Inverse Depth Parametrization

FREDRIK PAULSSON: Development of an Adaptive Voice Amplifier for Medical Purposes

FREDRIK EKLUND: Development of an Adaptive Voice Amplifier for Medical Purposes

MIKAIL BOHLIN: Test bench for a Distributed Data Collector (DDC)

JOHAN SÖDERROOS: Prediction of Expected Life Length of Motor Locks

PATRIK BJÖRKMAN: Development of a collision avoidance system for a videoconferencing robot

LARS ODENS HEDMAN: Development of a collision avoidance system for a videoconferencing robot