

Hardware-Software Co-design Research Group (Lissom@FIT)

/ Department of Information Systems / Faculty of Information Technology
/ Brno University of Technology

RESEARCH CONTACT



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THEMATIC RESEARCH FOCUS

RESEARCH AREA

- » Automation of hardware/software co-design for embedded systems and Multiprocessor System on the Chip (MPSoC)
- » Support for general de-compilation techniques (for example for anti-virus companies)

EXCELLENCE

- » Hardware/software co-design
- » Language for description of microprocessor architectures
- » Multiprocessor System on the Chip (MPSoC) design
- » De-compilation techniques for various binary formats

MISSION

We hope the automation of HW/SW co-design for the embedded and multiprocessor system is a very perspective area of interest. We would like to participate in the best projects and provide our PhD students and young researchers with opportunities to cooperate with leading partners in our area of interest.

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

The goal of the Lissom project is creation and especially implementation of a language for description of microprocessor architecture. For a good applicability of the language, it is necessary to create a development environment, which provides simultaneous development of both software tools and microprocessor hardware. Due to the concurrent work on hardware and software (hardware/software co-design), the total time of the development will be reduced and the developmental cycle will be shortened. The energy consumption of the processor can be also optimized. It is also possible to generate de-compilers for various microprocessor binary codes. The project is concentrated on:

- » Development of a fully automated design of a hardware and software for embedded systems
- » Design of Multiprocessor System on the Chip (MPSoC) technology for embedded systems
- » Integrated development environments for microprocessor development
- » Fundamental modification of an existing architecture description languages for the purpose of increasing their modelling skills
- » New practices of formal languages and models for the purpose of model simplification
- » Description of transformation of microprocessor's model between different languages
- » Synthesizable hardware model of microprocessor for industrial microprocessor production

MAIN CAPABILITIES

Basic research

- » Formal models of internal processor representation
- » New compilation techniques
- » Verification techniques
- » Model equivalence checking

Application research

- » Tools for automation of hardware/software co-design for embedded systems and Multiprocessor System on the Chip (MPSoC) development
- » Tools for support of general de-compilation techniques development (for example for anti-virus companies)

FIELDS OF RESEARCH RESULTS APPLICATION

- » Embedded systems (smart phones, tablets, game consoles, home digital systems, automotive industry)
- » Applications for anti-virus companies
- » Generally, all the branches which deal with microprocessor technology



ALUMNI PROFILE

Besides very good knowledge and skills in the general area of information technology, our graduates specialize in development and applications of information systems, intelligent systems, computer graphics and multimedia, computer and embedded systems, security and networks. Owing to a very good theoretical and wide, universal base of their specialization, a high adaptability in their future professional practice is ensured.

NUMBER OF RESEARCH POSITIONS ↘

SENIOR RESEARCH STAFF

6

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

14

KEY RESEARCH EQUIPMENT ↘

LIST OF DEVICES

- » Integrated development environment Codasip® for Application Specific Instruction-set Processors (ASIP) and Multiprocessor System on a Chip (MPSoC) applications. Time savings are accomplished by automation of tasks that would otherwise be done manually, e.g. creation of the tool-chain or of the hardware description.

BUDGET ↘

TOTAL (MIL. CZK/ MIL. EUR)

6 / 0.24

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%)

20

PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%)

30

MAIN PROJECTS ↘

2011–2013: Improving Security of the Internet by Using System for Analyzing of Malicious Code Spreading (TA01010858, financed by the Technology Agency of the Czech Republic)

2011–2013: System for Support of Platform Independent Malware Analysis in Executable Files (TA01010667, financed by the Technology Agency of the Czech Republic)

2010–2013: SMECY-Smart Multicore Embedded SYstems (ARTEMIS JU 100230, financed by Artemis JU)

2009–2013: System for programming and realization of embedded systems (FR-T11/038, financed by the Ministry of Industry and Trade of the Czech Republic)

ACHIEVEMENTS ↘

- » **2011 Příkryl Zdeněk, Křoustek Jakub, Hruška Tomáš, Kolář Dušan, Masařík Karel, Husár Adam:** Design and Simulation of High Performance Parallel Architectures Using the ISAC Language, In: GSTF International Journal on Computing, roč. 1, č. 2, 2011, Singapur, SG, s. 97-106, ISSN 2010-2283
- » **2011 Příkryl Zdeněk, Křoustek Jakub, Hruška Tomáš, Kolář Dušan:** Fast Just-In-Time Translated Simulation for ASIP Design, In: 14th IEEE International Symposium on Design and Diagnostics of Electronic Circuits and Systems, Cottbus, DE, IEEE CS, 2011, s. 279-282, ISBN 978-1-4244-9753-9
- » **2010 Příkryl Zdeněk, Křoustek Jakub, Hruška Tomáš, Kolář Dušan, Masařík Karel, Husár Adam:** Design and Debugging of Parallel Architectures Using the ISAC Language, In: Proceedings of the Annual International Conference on Advanced Distributed and Parallel Computing and Real-Time and Embedded Systems, Singapore, SG, GSTF, 2010, s. 213-221, ISBN 978-981-08-7656-2
- » **2009 Příkryl Zdeněk, Masařík Karel, Hruška Tomáš, Husár Adam:** Fast Cycle-Accurate Interpreted Simulation, In: Tenth International Workshop on Microprocessor Test and Verification: Common Challenges and Solutions, Austin, US, ICSP, 2009, s. 9-14, ISBN 978-0-7695-4000-9

MAIN COLLABORATING PARTNERS ↘

COLLABORATION WITH ACADEMIC PARTNERS

- » Institute of Information Theory and Automation (Prague, CZ)
- » Czech Technical University (Prague, CZ)

COLLABORATION WITH COMPANIES

- » AVG Technologies CZ (San Mateo, CA)
- » ApS Brno (Brno, CZ)
- » AVG Technologies CZ (Brno, CZ)
- » CAMEA (Brno, CZ)
- » CHIPINVEST (Brno, CZ)
- » Vema (Brno, CZ)

EXPECTATIONS ↘

OFFERS

- » Partnership in (mainly) international projects in the above described area
- » Codasip® System applications which demand microprocessors description in co-operation with software/hardware generators capabilities
- » Modelling and generation of tools for automation of hardware/ software co-design for embedded systems and Multiprocessor System on the Chip (MPSoC)

REQUIREMENTS

- » Partnership in (mainly) international projects in the above described area
- » Research cooperation with other academic and commercial institution
- » Testing of functional properties of the Codasip® System

05 / 2011