

# Dr. rer. nat. Jörg Brauer

## Contact



| Email: [brauer\[at\]embedded\[dot\]rwth-aachen\[dot\]de](mailto:brauer[at]embedded[dot]rwth-aachen[dot]de)

*"Luck favors the prepared mind."*  
Louis Pasteur, 1822-1895

## About me

I moved to Bremen.

Prior to moving up north, I used to be a PhD student heading the [\[mc\]square](#) project. [mc]square is a verification platform for microcontroller binary code. The key idea in [mc]square is to combine different formal methods in order to analyze hardware-specific microcontroller code. My own focus is the development of static analysis and abstract interpretation techniques specifically suited for verifying bit-twiddling programs. I am also involved in the [CEVTES](#) project, which is a joint project with the TU Vienna and the UAS Technikum Vienna on test-case generation for binary code.

Before I joined the Embedded Software Laboratory, I received my diploma degree from the Christian-Albrechts University of Kiel and visited [NICTA](#) in Sydney, Australia. At NICTA, I worked on [Goanna](#), a static analyzer for the C/C++ programming languages.

See [my CV](#) for more details.

## News

- **16/03/2012:** Today I had my last day in Aachen, I leave the Embedded Software Laboratory to work in industry.
- **06/03/2012:** The slides for my presentation on automatic abstraction at the [Compiler Design Lab](#) in Saarbrücken are available [here](#).
- **05/03/2012:** The slides for my talk at the Max-Planck Institute in Saarbrücken are available from [here](#).
- **01/03/2012:** The slides for my talk at [InBot'12](#) are available from [here](#).
- **24/01/2012:** The paper [Inferring Definite Counterexamples Through Under-Approximation](#),

- which I co-authored with [Axel Simon](#) from the TU Munich, was accepted to the [4th NASA Formal Methods Symposium \(NFM 2012\)](#).
- **22/11/2011:** I gave an invited talk at CEA, LIST in Paris about automatic generation of abstraction for binary code. The slides are available from [here](#).
  - **15/11/2011:** Today, I gave an invited talk about formal verification of PLC software at the University of Bremen. The slides are available from [here](#).
  - **03/11/2011:** I gave an invited talk on automatic abstraction for bit-vector relations at the TU Vienna and the IST Austria.
  - **01/09/2011:** I have received a best paper award from [FMICS'11](#) for the paper [Past Time LTL Runtime Verification for Microcontroller Binary Code](#). The paper was co-authored [Thomas Reinbacher](#), [Martin Horauer](#), [Andreas Steininger](#) and [Stefan Kowalewski](#).
  - **01/08/2011:** The paper *Automated Test-Trace Inspection for Microcontroller Binary Code* which I co-authored with [Thomas Reinbacher](#), [Daniel Schachinger](#) and [Andreas Steininger](#) from the TU Vienna as well as [Stefan Kowalewski](#) from our group was accepted to [RV'11](#).
  - **20/07/2011:** The implementation for my [CAV'11 paper](#) is available from <http://www.cs.kent.ac.uk/amkdistribution>.
  - **03/07/2011:** The paper *Precise Control Flow Reconstruction Using Boolean Logic* that I co-authored with [Thomas Reinbacher](#), my colleague from TU Vienna, has been accepted to [EMSOFT'11](#). In this paper, me and Thomas combine several techniques such as bit-blasting, my elimination algorithm from CAV and forward/backward analysis to compute fairly precise approximations of CFGs from binary code.
  - **01/07/2011:** The paper *Adaptable Value-Set Analysis for Low-Level Code* that I have co-authored with [René Rydhof Hansen](#), [Kim G. Larsen](#) and [Mads Chr. Olesen](#) from Aalborg University as well as [Stefan Kowalewski](#) from our department was accepted for presentation at [SSV'11](#).
  - **10/06/2011:** I was invited to give a talk at the [MT-LAB](#) meeting in Copenhagen. The MT-LAB is a Danish research centre for formal methods, and the talk was about my work on existential quantifier elimination.
  - **06/05/2011:** The paper [Past Time LTL Runtime Verification for Microcontroller Binary Code](#) that I have co-authored with [Thomas Reinbacher](#), [Martin Horauer](#), [Andreas Steininger](#) and [Stefan Kowalewski](#) was accepted for [FMICS'11](#). The workshop will be held in Trento, Italy around end of August.
  - **06/04/2011:** We have assembled a [programme committee](#) for [SSV 2011](#). Additionally, a call for papers is available [here](#).
  - **22/03/2011:** The paper [Existential Quantification as Incremental SAT](#) which I co-authored with [Andy King](#) and [Jael Kriener](#) was accepted for [CAV'11](#). Yeah!
  - **14/03/2011:** [SSV 2011](#) will be co-located with the [2nd Conference on Interactive Theorem Proving \(ITP\)](#) in Nijmegen, The Netherlands. ITP will take place from August 22 till August 25, and SSV will be held as a 2-day workshop starting the day thereafter.
  - **11/03/2011:** I will be visiting the group of [Kim G. Larsen](#) in Aalborg from April till June. Hence, if you need to contact me, please try via email.
  - **10/02/2011:** Together with [Marco Roveri](#) (FBK-IRST, Trento) and [Hendrik Tews](#) (TU Dresden), I will co-chair the [6th International Workshop on Systems Software Verification \(SSV 2011\)](#).
  - **09/02/2011:** My paper [Approximate Quantifier Elimination for Propositional Boolean Formulae](#) co-authored with [Andy King](#) was accepted for [NFM'11](#).
  - **07/12/2010:** My paper [Transfer Function Synthesis without Quantifier Elimination](#) co-authored with [Andy King](#) was accepted for [ESOP'11](#).
  - **28/10/2010:** Together with [Thomas Reinbacher](#), [Martin Horauer](#), [Andreas Steininger](#) and [Stefan Kowalewski](#), I received a best paper award for our contribution to [MEMICS'10](#).
  - **08/06/2010:** My paper [Range Analysis of Microcontroller Code using Bit-Level Congruences](#) co-

authored with [Andy King](#) and [Stefan Kowalewski](#) was accepted for [FMICS'10](#).

- **04/05/2010:** My paper [Automatic Abstraction for Intervals using Boolean Formulae](#) co-authored with [Andy King](#) was accepted for [SAS'10](#).

## Research Interests

- abstract interpretation of bit-vector programs (see [\[mc\]square](#)), in particular using *automatic abstraction*
- relational abstract domains
- formal verification
- software model checking
- software for embedded systems

In summary, I combine theoretical computer science with low-level programming, for example, by automatically deriving invariants for bit-twiddling binary code. I particularly enjoy utilizing SAT/SMT solvers for solving such problems. If you interested in this topic, you might want to check out [my SAS'10 paper](#) or [my ESOP'11 paper](#), which give a good feel about how precise SAT-based abstract interpretation of bit-vector programs (such as assembly code) can get. However, to make such techniques scale, you need to apply certain other techniques, such as the projection algorithm from [my CAV'11 paper](#).

## Professional Activities

- Symposium co-chair for the Symposium on Design & Verification Methodologies for Embedded Systems, which is a symposium within the IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications (MESA) 2012 in Suzhou, China.
- Co-chair of the [6th International Workshop on Systems Software Verification](#) (SSV 2011) in Nijmegen, The Netherlands.
- Co-chair for the 4th Symposium on Design & Verification Tools for Embedded Systems (DVTES 2011) at [IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications \(MESA\) 2011](#) in Washington DC, USA
- Program committee for the [15th International Workshop on Formal Methods for Industrial Critical Systems \(FMICS 2010\)](#) in Antwerp, Belgium
- Local organizer for the [4th International Workshop on Systems Software Verification \(SSV 2009\)](#) in Aachen, Germany

## B.Sc./M.Sc./Diploma Theses

We always have a number of different topics for diploma, bachelors, and masters theses in the [\[mc\]square](#) project. Even though I do not supervise theses myself anymore, please contact me if you are interested in working on verification in the field of embedded software, preferably via email. We can probably find an interesting topic and a supervisor.

- **Ongoing**
- **Finished**

- Na Bai (Diploma): *Dataflow Analysis for PLCs (September 2011)*
- Sebastian Biallas (Diploma): *Counterexample-Guided Abstraction Refinement for Programmable Logic Controllers (April 2010)*
- Frank Birbacher (Diploma): *Relational Static Analysis of IL-Programs using Congruences*
- Lucas Brutschy (B.Sc.): *Static Analysis of Microcontroller Software using SAT- and Constraint-Solving (August 2009)*
- Mustafa Karafil (Diploma): *Recovering Indirect Control Flow in Binary Code (August 2011)*
- Jörg Toborg (Diploma): *Static Analysis for the Renesas R8C/23 Tiny Microcontroller (February 2010)*

## Publications

A more detailed list of my publications can be found [here](#) (including abstracts), and a list of my co-authors can be found [here](#).

[RBH+14]

[PDFBIB](#)

Reinbacher, T., Brauer, J., Horauer, M., Steininger, A., and Kowalewski, S., "Runtime verification of microcontroller binary code", *Science of computer programming*, vol. 80, pp. 109-129, 2014

## Runtime verification of microcontroller binary code

### Bibtex entry :

```
@article { RBH+14,  
  author = { Reinbacher, Thomas and Brauer, J{"o}rg and Horauer,  
  Martin  
    and Steininger, Andreas and Kowalewski, Stefan },  
  title = { Runtime verification of microcontroller binary code },  
  journal = { Science of computer programming },  
  publisher = { Elsevier },  
  pages = { 109-129 },  
  volume = { 80 },  
  year = { 2014 },  
  address = { Amsterdam },  
  issn = { 0167-6423 },  
  doi = { 10.1016/j.scico.2012.10.015 },  
  typ = { PUB:(DE-HGF)16 },  
  reportid = { RWTH-CONV-080463 },  
  cin = { 120000 / 122810 },  
  url = { http://publications.rwth-aachen.de/record/231479 },  
}
```

[RFB14]

[PDFBIB](#)

Reinbacher, T., Fuegger, M., and Brauer, J., "Runtime verification of embedded real-time systems", *Formal methods in system design*, vol. 44, iss. 3, pp. 203-239, 2014

# Runtime verification of embedded real-time systems

## Bibtex entry :

```
@article { RFB14,
  author = { Reinbacher, Thomas and Fuegger, Matthias and Brauer,
    J{\\"o}rg },
  title = { Runtime verification of embedded real-time systems },
  journal = { Formal methods in system design },
  publisher = { Springer Science + Business Media B.V },
  pages = { 203-239 },
  volume = { 44 },
  number = { 3 },
  year = { 2014 },
  address = { Dordrecht },
  issn = { 0925-9856 },
  doi = { 10.1007/s10703-013-0199-z },
  typ = { PUB:(DE-HGF)16 },
  reportid = { RWTH-CONV-089599 },
  cin = { 120000 / 122810 },
  url = { http://publications.rwth-aachen.de/record/446689 },
}
```

[BK13]

[PDFBIB](#)

Brauer, J. and Kowalewski, S., "Automatic abstraction for bit vectors using decision procedures", Aachen, AIB 2013 14, 2013.

## Automatic abstraction for bit vectors using decision procedures

## Bibtex entry :

```
@techreport { BK13,
  author = { Brauer, J{\\"o}rg and Kowalewski, Stefan },
  title = { Automatic abstraction for bit vectors using decision
    procedures },
  publisher = { Fachgruppe Informatik, RWTH Aachen University },
  pages = { IV, 207 S. : graph. Darst. },
  volume = { 2013,14 },
  number = { AIB 2013 14 },
  series = { Aachener Informatik-Berichte },
  year = { 2013 },
  address = { Aachen },
  typ = { PUB:(DE-HGF)11 },
  reportid = { RWTH-CONV-010470 },
  cin = { 120000 / 122810 },
  url = {
    http://publications.rwth-aachen.de/record/229199/files/4836.pdf },
}
```

```
}
```

[BKK13]

[PDFBIB](#)

Brauer, J., King, A., and Kowalewski, S., "Abstract interpretation of microcontroller code: Intervals meet congruences", *Science of computer programming*, vol. 78, iss. 7, pp. 862-883, 2013

## Abstract interpretation of microcontroller code: Intervals meet congruences

**Bibtex entry :**

```
@article { BKK13,  
  author = { Brauer, J{\\"o}rg and King, Andy and Kowalewski, Stefan  
},  
  title = { Abstract interpretation of microcontroller code:  
Intervals  
  meet congruences },  
  journal = { Science of computer programming },  
  publisher = { Elsevier },  
  pages = { 862-883 },  
  volume = { 78 },  
  number = { 7 },  
  year = { 2013 },  
  address = { Amsterdam [u.a.] },  
  issn = { 0167-6423 },  
  doi = { 10.1016/j.scico.2012.06.001 },  
  typ = { PUB:(DE-HGF)16 },  
  reportid = { RWTH-CONV-086725 },  
  cin = { 120000 / 122810 },  
  url = { http://publications.rwth-aachen.de/record/238031 },  
}
```

[KPB13]

[PDFBIB](#)

Kowalewski, S., Philippou, A., and Brauer, J., "Model checking and abstract interpretation as building blocks of advanced program analysis techniques", *International journal on software tools for technology transfer : STTT*, vol. 15, iss. 4, pp. 287-289, 2013

## Model checking and abstract interpretation as building blocks of advanced program analysis techniques

**Bibtex entry :**

```
@article { KPB13,  
  author = { Kowalewski, Stefan and Philippou, A. and Brauer, J. },  
  title = { Model checking and abstract interpretation as building  
  blocks of advanced program analysis techniques },
```

```
journal = { International journal on software tools for technology
  transfer : STTT },
publisher = { Springer },
pages = { 287-289 },
volume = { 15 },
number = { 4 },
year = { 2013 },
address = { Berlin ; Heidelberg [u.a.] },
issn = { 1433-2787 },
organization = { 15th International Conference, TACAS 2009, York
(UK),
  2009-03-22 - 2009-03-29 },
doi = { 10.1007/s10009-013-0280-3 },
typ = { PUB:(DE-HGF)16 },
reportid = { RWTH-CONV-236324 },
cin = { 122810 / 120000 },
url = { http://publications.rwth-aachen.de/record/752289 },
}
```

[BBK+12]

[PDFBIB](#)

Biallas, S., Brauer, J., King, A., and Kowalewski, S., "Loop Leaping with Closures", in *Proc. Static Analysis : 19th International Symposium, SAS 2012, Deauville, France, September 11-13, 2012. Proceedings / edited by Antoine Miné, David Schmidt*, Berlin, Heidelberg, 2012 in *Lecture Notes in Computer Science*, Springer, pp. 214-230.

## Loop Leaping with Closures

### Bibtex entry :

```
@inproceedings { BBK+12,
  author = { Biallas, Sebastian and Brauer, J{"o}rg and King, Andy
and
  Kowalewski, Stefan },
  title = { Loop Leaping with Closures },
  booktitle = { Static Analysis : 19th International Symposium, SAS
2012,
  Deauville, France, September 11-13, 2012. Proceedings /
  edited by Antoine Miné, David Schmidt },
  publisher = { Springer },
  pages = { 214-230 },
  series = { Lecture Notes in Computer Science },
  year = { 2012 },
  address = { Berlin, Heidelberg },
  organization = { Static Analysis : 19th International Symposium,
Deauville
  (France), 2012-09-11 - 2012-09-13 },
  typ = { PUB:(DE-HGF)7 },
  reportid = { RWTH-CONV-236335 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/752305 },
```

```
}
```

[BBK12a]

[PDFBIB](#)

Beckschulze, E., Brauer, J., and Kowalewski, S., "Access-Based Localization for Octagons", *Electronic notes in theoretical computer science : ENTCS*, vol. 287, pp. 29-40, 2012

## Access-Based Localization for Octagons

**Bibtex entry :**

```
@article { BBK12a,  
  author = { Beckschulze, Eva and Brauer, J{"o}rg and Kowalewski,  
Stefan },  
  title = { Access-Based Localization for Octagons },  
  journal = { Electronic notes in theoretical computer science :  
ENTCS },  
  publisher = { Elsevier Science },  
  pages = { 29-40 },  
  volume = { 287 },  
  year = { 2012 },  
  address = { Amsterdam [u.a.] },  
  issn = { 1571-0661 },  
  typ = { PUB:(DE-HGF)16 },  
  reportid = { RWTH-CONV-043099 },  
  cin = { 122810 / 120000 },  
  url = { http://publications.rwth-aachen.de/record/165238 },  
}
```

[BBK12b]

[PDFBIB](#)

Biallas, S., Brauer, J., and Kowalewski, S., "Arcade.PLC : a Verification Platform for Programmable Logic Controllers", in *Proc. 2012 proceedings of the 27th IEEE/ACM International Conference on Automated Software Engineering (ASE 2012) : Essen, Germany, 3 - 7 September 2012*, Piscataway, NJ, 2012, IEEE, pp. 338-341.

## Arcade.PLC : a Verification Platform for Programmable Logic Controllers

**Bibtex entry :**

```
@inproceedings { BBK12b,  
  author = { Biallas, Sebastian and Brauer, J{"o}rg and Kowalewski,  
Stefan },  
  title = { Arcade.PLC : a Verification Platform for Programmable  
Logic  
Controllers },  
  booktitle = { 2012 proceedings of the 27th IEEE/ACM International  
Conference on Automated Software Engineering (ASE 2012) :  
Essen, Germany, 3 - 7 September 2012 },
```



```

publisher = { IEEE },
pages = { 338-341 },
year = { 2012 },
address = { Piscataway, NJ },
doi = { 10.1145/2351676.2351741 },
typ = { PUB:(DE-HGF)8 },
reportid = { RWTH-CONV-170936 },
cin = { 120000 / 122810 },
url = { http://publications.rwth-aachen.de/record/97761 },
}

```

[BHK+12]

[PDFBIB](#)

Brauer, J., Hansen, R. R., Kowalewski, S., Larsen, K. G., and Olesen, M. C., "Adaptable Value-Set Analysis for Low-Level Code", in *Proc. 6th International Workshop on Systems Software Verification (SSV 2011) [Elektronische Ressource] / Hrsg.: Jörg Brauer ; Marco Roveri ; Hendrik Tews*, Wadern, 2012 in OASlcs - OpenAccess Series in Informatics, Schloss Dagstuhl - Leibniz-Zentrum für Informatik, pp. 32-43.

## Adaptable Value-Set Analysis for Low-Level Code

### Bibtex entry :

```

@inproceedings { BHK+12,
  author = { Brauer, J{\o}rg and Hansen, Rene Rydhof and Kowalewski,
    Stefan and Larsen, Kim G. and Olesen, Mads Chr. },
  title = { Adaptable Value-Set Analysis for Low-Level Code },
  booktitle = { 6th International Workshop on Systems Software
Verification
  (SSV 2011) [Elektronische Ressource] / Hrsg.: J{\o}rg
  Brauer ; Marco Roveri ; Hendrik Tews },
  publisher = { Schloss Dagstuhl - Leibniz-Zentrum f{\u}r Informatik
},
  pages = { 32-43 },
  series = { OASlcs - OpenAccess Series in Informatics },
  year = { 2012 },
  address = { Wadern },
  doi = { 10.4230/OASlcs.SSV.2011.32 },
  typ = { PUB:(DE-HGF)8 },
  reportid = { RWTH-CONV-198838 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/128784 },
}

```

[BK12a]

[PDFBIB](#)

Brauer, J. and King, A., "Transfer function synthesis without quantifier elimination", *Logical methods in computer science : LMCS*, vol. 8, iss. 3, 2012

# Transfer function synthesis without quantifier elimination

## Bibtex entry :

```
@article { BK12a,  
  author = { Brauer, J{\\"o}rg and King, Andy },  
  title = { Transfer function synthesis without quantifier  
elimination },  
  journal = { Logical methods in computer science : LMCS },  
  publisher = { Department of Theoretical Computer Science, TU [u.a.]  
},  
  volume = { 8 },  
  number = { 3 },  
  year = { 2012 },  
  address = { Braunschweig },  
  issn = { 1860-5974 },  
  doi = { 10.2168/LMCS-8(3:17)2012 },  
  typ = { PUB:(DE-HGF)16 },  
  reportid = { RWTH-CONV-079893 },  
  cin = { 120000 / 122810 },  
  url = {  
http://publications.rwth-aachen.de/record/218122/files/218122.pdf },  
}
```

[BS12]

[PDFBIB](#)

Brauer, J. and Simon, A., "Inferring Definite Counterexamples Through Under-Approximation", in *Proc. NASA formal methods : 4th international symposium, NFM 2012, Norfolk, VA, USA, April 3 - 5, 2012 ; proceedings / Alwyn E. Goodloe; Suzette Person (ed.)*, Berlin ; Heidelberg [u.a.], 2012 in *Lecture Notes in Computer Science*, Springer, pp. 54-69.

## Inferring Definite Counterexamples Through Under-Approximation

### Bibtex entry :

```
@inproceedings { BS12,  
  author = { Brauer, J{\\"o}rg and Simon, Axel },  
  title = { Inferring Definite Counterexamples Through  
Under-Approximation },  
  booktitle = { NASA formal methods : 4th international symposium,  
NFM 2012,  
Norfolk, VA, USA, April 3 - 5, 2012 ; proceedings / Alwyn E.  
Goodloe; Suzette Person (ed.) },  
  publisher = { Springer },  
  pages = { 54-69 },  
  series = { Lecture Notes in Computer Science },  
  year = { 2012 },
```

```
address = { Berlin ; Heidelberg [u.a.] },
typ = { PUB:(DE-HGF)8 },
reportid = { RWTH-CONV-194497 },
cin = { 122810 / 120000 },
url = { http://publications.rwth-aachen.de/record/123648 },
}
```

[BSK12]

[PDFBIB](#)

Brauer, J., Schlich, B., and Kowalewski, S., "Parallel and distributed invariant checking of microcontroller software", *Electronic notes in theoretical computer science : ENTCS*, vol. 287, pp. 45-63, 2012

## Parallel and distributed invariant checking of microcontroller software

### Bibtex entry :

```
@article { BSK12,
  author = { Brauer, J{\\"o}rg and Schlich, Bastian and Kowalewski, Stefan },
  title = { Parallel and distributed invariant checking of
    microcontroller software },
  journal = { Electronic notes in theoretical computer science :
    ENTCS },
  publisher = { Elsevier Science },
  pages = { 45-63 },
  volume = { 287 },
  year = { 2012 },
  address = { Amsterdam [u.a.] },
  issn = { 1571-0661 },
  doi = { 10.1016/j.entcs.2009.09.059 },
  typ = { PUB:(DE-HGF)16 },
  reportid = { RWTH-CONV-013643 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/132534 },
}
```

[BBK+11]

[PDFBIB](#)

Biallas, S., Brauer, J., Kowalewski, S., and Schlich, B., "Automatically Deriving Symbolic Invariants for PLC Programs Written in IL", in *Proc. Formal methods for automation and safety in railway and automotive systems : FORMS/FORMAT 2010 ; [8th symposium ; proceedings] / Eckehard Schnieder; Géza Tarnai, eds.*, Heidelberg [u.a.], 2011, Springer, pp. 237-245.

## Automatically Deriving Symbolic Invariants for PLC Programs Written in IL

## Bibtex entry :

```
@inproceedings { BBK+11,  
  author = { Biallas, Sebastian and Brauer, J{"o}rg and Kowalewski,  
            Stefan and Schlich, Bastian },  
  title = { Automatically Deriving Symbolic Invariants for PLC  
Programs  
          Written in IL },  
  booktitle = { Formal methods for automation and safety in railway  
and  
               automotive systems : FORMS/FORMAT 2010 ; [8th symposium ;  
               proceedings] / Eckehard Schnieder; Géza Tarnai, eds. },  
  publisher = { Springer },  
  pages = { 237-245 },  
  year = { 2011 },  
  address = { Heidelberg [u.a.] },  
  doi = { 10.1007/978-3-642-14261-1 },  
  typ = { PUB:(DE-HGF)8 },  
  reportid = { RWTH-CONV-196797 },  
  cin = { 122810 / 120000 },  
  url = { http://publications.rwth-aachen.de/record/126461 },  
}
```

[BBK11]

[PDFBIB](#)

Biallas, S., Brauer, J., and Kowalewski, S., "SAT-Based Abstraction Refinement for Programmable Logic Controllers", in *Proc. 3rd International Workshop on Dependable Control of Discrete Systems 2011, DCDS 2011, Saarbrücken, Germany, 15th-17th June 2011*, Piscataway, NJ, 2011, IEEE, pp. 96-101.

## SAT-Based Abstraction Refinement for Programmable Logic Controllers

### Bibtex entry :

```
@inproceedings { BBK11,  
  author = { Biallas, Sebastian and Brauer, J{"o}rg and Kowalewski,  
            Stefan },  
  title = { SAT-Based Abstraction Refinement for Programmable Logic  
Controllers },  
  booktitle = { 3rd International Workshop on Dependable Control of  
Discrete  
               Systems 2011, DCDS 2011, Saarbr{"u}cken, Germany,  
               15th-17th June 2011 },  
  publisher = { IEEE },  
  pages = { 96-101 },  
  year = { 2011 },  
  address = { Piscataway, NJ },  
  typ = { PUB:(DE-HGF)8 },  
  reportid = { RWTH-CONV-194508 },
```

```

cin = { 122810 / 120000 },
url = {
http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=05970325 },
}

```

[BBS+11]

[PDFBIB](#)

Beckschulze, E., Brauer, J., Stollenwerk, A., and Kowalewski, S., "Analyzing Embedded Systems Code for Mixed-Critical Systems Using Hybrid Memory Representations", in *Proc. 2011 14th IEEE International Symposium on Object/Component/Service-Oriented Real-Time Distributed Computing workshops (ISORCW) : 28 - 31 March 2011, Newport Beach, California, USA ; proceedings*, Piscataway, NJ, 2011, IEEE, pp. 33-40.

## Analyzing Embedded Systems Code for Mixed-Critical Systems Using Hybrid Memory Representations

### Bibtex entry :

```

@inproceedings { BBS+11,
  author = { Beckschulze, Eva and Brauer, J{"o}rg and Stollenwerk,
    André and Kowalewski, Stefan },
  title = { Analyzing Embedded Systems Code for Mixed-Critical
    Systems
      Using Hybrid Memory Representations },
  booktitle = { 2011 14th IEEE International Symposium on
    Object/Component/Service-Oriented Real-Time Distributed
    Computing workshops (ISORCW) : 28 - 31 March 2011, Newport
    Beach, California, USA ; proceedings },
  publisher = { IEEE },
  pages = { 33-40 },
  year = { 2011 },
  address = { Piscataway, NJ },
  organization = { 14th IEEE International Symposium on
    Object/Component/Service-Oriented Real-Time Distributed
    Computing, Newport Beach, CA (USA), 2011-03-28 - 2011-08-31 },
  doi = { 10.1109/ISORCW.2011.40 },
  typ = { PUB:(DE-HGF)7 },
  reportid = { RWTH-CONV-194737 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/124002 },
}

```

[BK11]

[PDFBIB](#)

Brauer, J. and King, A., "Approximate Quantifier Elimination for Propositional Boolean Formulae", in *Proc. NASA formal methods : third international symposium, NFM 2011, Pasadena, CA, USA, April 18-20, 2011 ; proceedings / Mihaela Bobaru ... (eds.)*, Heidelberg [u.a.], 2011 in Lecture Notes in Computer Science, Springer, pp. 73-88.

# Approximate Quantifier Elimination for Propositional Boolean Formulae

## Bibtex entry :

```
@inproceedings { BK11,  
  author = { Brauer, J{\\"o}rg and King, Andy },  
  title = { Approximate Quantifier Elimination for Propositional  
Boolean  
  Formulae },  
  booktitle = { NASA formal methods : third international symposium,  
NFM  
  2011, Pasadena, CA, USA, April 18-20, 2011 ; proceedings /  
  Mihaela Bobaru ... (eds.) },  
  publisher = { Springer },  
  pages = { 73-88 },  
  series = { Lecture Notes in Computer Science },  
  year = { 2011 },  
  address = { Heidelberg [u.a.] },  
  doi = { 10.1007/978-3-642-20398-5 },  
  typ = { PUB:(DE-HGF)8 },  
  reportid = { RWTH-CONV-194773 },  
  cin = { 122810 / 120000 },  
  url = { http://publications.rwth-aachen.de/record/124043 },  
}
```

[BK11a]

[PDFBIB](#)

Brauer, J. and King, A., "Transfer Function Synthesis without Quantifier Elimination", in *Proc. Programming languages and systems : 20th European Symposium on Programming, ESOP 2011, held as part of the Joint European Conference on Theory and Practice of Software, ETAPS 2011, Saarbrücken, Germany, March 26-April 3, 2011 ; proceedings / Gilles Barthe (ed.)*, Heidelberg [u.a.], 2011 in Lecture notes in computer science, Springer, pp. 97-115.

# Transfer Function Synthesis without Quantifier Elimination

## Bibtex entry :

```
@inproceedings { BK11a,  
  author = { Brauer, J{\\"o}rg and King, Andy },  
  title = { Transfer Function Synthesis without Quantifier  
Elimination },  
  booktitle = { Programming languages and systems : 20th European  
Symposium  
  on Programming, ESOP 2011, held as part of the Joint  
  European Conference on Theory and Practice of Software,  
  ETAPS 2011, Saarbr{\\"u}cken, Germany, March 26-April 3, 2011  
  ; proceedings / Gilles Barthe (ed.) },
```

```

publisher = { Springer },
pages = { 97-115 },
series = { Lecture notes in computer science },
year = { 2011 },
address = { Heidelberg [u.a.] },
doi = { 10.1007/978-3-642-19718-5 },
typ = { PUB:(DE-HGF)8 },
reportid = { RWTH-CONV-196794 },
cin = { 122810 / 120000 },
url = { http://publications.rwth-aachen.de/record/126458 },
}

```

[BKK11]

[PDFBIB](#)

Brauer, J., King, A., and Kriener, J., "Existential Quantification as Incremental SAT", in *Proc. Computer aided verification : 23rd international conference, CAV 2011, Snowbird, UT, USA, July 14-20, 2011 ; proceedings / Ganesh Gopalakrishnan; Shaz Qadeer (eds.)*, Heidelberg [u.a.], 2011 in Lecture notes in computer science, Springer, pp. 191-207.

## Existential Quantification as Incremental SAT

### Bibtex entry :

```

@inproceedings { BKK11,
  author = { Brauer, J{\\"o}rg and King, Andy and Kriener, Jael },
  title = { Existential Quantification as Incremental SAT },
  booktitle = { Computer aided verification : 23rd international
conference,
  CAV 2011, Snowbird, UT, USA, July 14-20, 2011 ; proceedings
  / Ganesh Gopalakrishnan; Shaz Qadeer (eds.) },
  publisher = { Springer },
  pages = { 191-207 },
  series = { Lecture notes in computer science },
  year = { 2011 },
  address = { Heidelberg [u.a.] },
  doi = { 10.1007/978-3-642-22110-1 },
  typ = { PUB:(DE-HGF)7 },
  reportid = { RWTH-CONV-196588 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/126209 },
}

```

[BRT11]

[PDFBIB](#)

Brauer, J., Roveri, M., and Tews, H., "Proceedings of the 6th International Workshop on Systems Software Verification (SSV 2011)", , Dresden, TUD-FI11-02-August 2011, 2011.

## Proceedings of the 6th International Workshop on

## Systems Software Verification (SSV 2011)

### Bibtex entry :

```
@techreport { BRT11,  
  author = { Brauer, Jörg and Roveri, Marco and Tews, Hendrik },  
  title = { Proceedings of the 6th International Workshop on Systems  
    Software Verification (SSV 2011) },  
  publisher = { TU },  
  pages = { 101 S. },  
  number = { TUD-FI11-02-August 2011 },  
  year = { 2011 },  
  address = { Dresden },  
  typ = { PUB:(DE-HGF)26 },  
  reportid = { RWTH-CONV-008161 },  
  cin = { 122810 / 120000 },  
  url = { https://es.fbk.eu/events/ssv2011/papers/proceedings.pdf },  
}
```

[RB11]

[PDFBIB](#)

Reinbacher, T. and Brauer, J., "Precise Control Flow Reconstruction Using Boolean Logic", in *Proc. EMSOFT '11 : Proceedings of the ninth ACM international conference on Embedded software ; October 9-14, 2011, Taipei, Taiwan*, New York, NY, 2011, ACM, pp. 117-126.

## Precise Control Flow Reconstruction Using Boolean Logic

### Bibtex entry :

```
@inproceedings { RB11,  
  author = { Reinbacher, Thomas and Brauer, Jörg },  
  title = { Precise Control Flow Reconstruction Using Boolean Logic  
},  
  booktitle = { EMSOFT '11 : Proceedings of the ninth ACM  
international  
  conference on Embedded software ; October 9-14, 2011,  
  Taipei, Taiwan },  
  publisher = { ACM },  
  pages = { 117-126 },  
  year = { 2011 },  
  address = { New York, NY },  
  doi = { 10.1145/2038642.2038662 },  
  typ = { PUB:(DE-HGF)8 },  
  reportid = { RWTH-CONV-198496 },  
  cin = { 122810 / 120000 },  
  url = { http://publications.rwth-aachen.de/record/128379 },  
}
```

[RBH+11]

[PDFBIB](#)



Reinbacher, T., Brauer, J., Horauer, M., Steininger, A., and Kowalewski, S., "Past Time LTL Runtime Verification for Microcontroller Binary Code", in *Proc. Formal methods for industrial critical systems : 16th international workshop, FMICS 2011, Trento, Italy, August 29 - 30, 2011 ; proceedings / Gwen Salaün; Bernhard Schätz (eds.)*, Heidelberg [u.a.], 2011 in Lecture notes in computer science, Springer, pp. 37-51.

## Past Time LTL Runtime Verification for Microcontroller Binary Code

### Bibtex entry :

```
@inproceedings { RBH+11,
  author = { Reinbacher, Thomas and Brauer, J{\\"o}rg and Horauer,
    Martin
      and Steininger, Andreas and Kowalewski, Stefan },
  title = { Past Time LTL Runtime Verification for Microcontroller
    Binary Code },
  booktitle = { Formal methods for industrial critical systems : 16th
    international workshop, FMICS 2011, Trento, Italy, August 29
    - 30, 2011 ; proceedings / Gwen Sala{\\"u}n; Bernhard
    Sch{\\"a}tz (eds.) },
  publisher = { Springer },
  pages = { 37-51 },
  series = { Lecture notes in computer science },
  year = { 2011 },
  address = { Heidelberg [u.a.] },
  doi = { 10.1007/978-3-642-24431-5 },
  typ = { PUB:(DE-HGF)8 },
  reportid = { RWTH-CONV-194606 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/123834 },
}
```

[RBS+11]

[PDFBIB](#)

Reinbacher, T., Brauer, J., Schachinger, D., Steininger, A., and Kowalewski, S., "Automated Test-Trace Inspection for Microcontroller Binary Code", in *Proc. Runtime Verification : Second International Conference, RV 2011, San Francisco, CA, USA, September 27-30, 2011, Revised Selected Papers / edited by Sarfraz Khurshid, Koushik Sen*, Berlin ; Heidelberg, 2011 in Lecture notes in computer science, Springer, pp. 239-244.

## Automated Test-Trace Inspection for Microcontroller Binary Code

### Bibtex entry :

```
@inproceedings { RBS+11,
  author = { Reinbacher, Thomas and Brauer, J{\\"o}rg and Schachinger,
    Daniel and Steininger, Andreas and Kowalewski, Stefan },
```

```
title = { Automated Test-Trace Inspection for Microcontroller  
Binary  
Code },  
booktitle = { Runtime Verification : Second International  
Conference, RV  
2011, San Francisco, CA, USA, September 27-30, 2011, Revised  
Selected Papers / edited by Sarfraz Khurshid, Koushik Sen },  
publisher = { Springer },  
pages = { 239-244 },  
series = { Lecture notes in computer science },  
year = { 2011 },  
address = { Berlin ; Heidelberg },  
doi = { 10.1007/978-3-642-29860-8_18 },  
typ = { PUB:(DE-HGF)8 },  
reportid = { RWTH-CONV-194496 },  
cin = { 122810 / 120000 },  
url = { http://publications.rwth-aachen.de/record/123647 },  
}
```

[RHS+11]

[PDFBIB](#)

Reinbacher, T., Horauer, M., Schlich, B., Brauer, J., and Scheuer, F., "Model checking embedded software of an industrial knitting machine", *International journal of information technology, communications and convergence*, vol. 1, iss. 2, pp. 186-205, 2011

## Model checking embedded software of an industrial knitting machine

### Bibtex entry :

```
@article { RHS+11,  
author = { Reinbacher, Thomas and Horauer, Martin and Schlich,  
Bastian  
and Brauer, J{"o}rg and Scheuer, Florian },  
title = { Model checking embedded software of an industrial  
knitting  
machine },  
journal = { International journal of information technology,  
communications and convergence },  
publisher = { Inderscience Publishers },  
pages = { 186-205 },  
volume = { 1 },  
number = { 2 },  
year = { 2011 },  
address = { Geneva },  
issn = { 2042-3217 },  
doi = { 10.1504/IJITCC.2011.039285 },  
typ = { PUB:(DE-HGF)16 },  
reportid = { RWTH-CONV-052838 },  
cin = { 122810 / 120000 },
```

```
url = { http://www.inderscience.com/IJITCC },
}
```

[RSM+11]

[PDFBIB](#)

Reinbacher, T., Steininger, A., Müller, T., Horauer, M., Brauer, J., and Kowalewski, S., "Hardware Support for Efficient Testing of Embedded Software", in *Proc. Proceedings of the ASME International Design Engineering Technical Conferences and Computers and Information in Engineering Conference - 2011 : presented at ASME 2011 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, August 28 - 31, 2011, Washington, D.C. / sponsored by the Design Engineering Division, ASME; the Computers and Information in Engineering Division, ASME. - Vol. 3: ASME/IEEE International Conference on Mechatronic and Embedded Systems and Applications, Pt. A, New York, NY, 2011, ASME, pp. 3-12.*

## Hardware Support for Efficient Testing of Embedded Software

### Bibtex entry :

```
@inproceedings { RSM+11,
  author = { Reinbacher, Thomas and Steininger, Andreas and
M{"u"}ller,
  Tobias and Horauer, Martin and Brauer, J{"o"}rg and
  Kowalewski, Stefan },
  title = { Hardware Support for Efficient Testing of Embedded
Software },
  booktitle = { Proceedings of the ASME International Design
Engineering
  Technical Conferences and Computers and Information in
Engineering Conference - 2011 : presented at ASME 2011
International Design Engineering Technical Conferences and
Computers and Information in Engineering Conference, August
28 - 31, 2011, Washington, D.C. / sponsored by the Design
Engineering Division, ASME; the Computers and Information in
Engineering Division, ASME. - Vol. 3: ASME/IEEE
International Conference on Mechatronic and Embedded Systems
and Applications, Pt. A },
  publisher = { ASME },
  pages = { 3-12 },
  year = { 2011 },
  address = { New York, NY },
  doi = { 10.1115/DETC2011-47139 },
  typ = { PUB:(DE-HGF)8 },
  reportid = { RWTH-CONV-195986 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/125522 },
}
```

[SBK11]

## PDFBIB

Schlich, B., Brauer, J., and Kowalewski, S., "Application of Static Analyses for State-Space Reduction to the Microcontroller Binary Code", *Science of computer programming*, vol. 76, iss. 2, pp. 100-118, 2011

# Application of Static Analyses for State-Space Reduction to the Microcontroller Binary Code

## Bibtex entry :

```
@article { SBK11,  
  author = { Schlich, Bastian and Brauer, J{"o}rg and Kowalewski,  
Stefan },  
  title = { Application of Static Analyses for State-Space Reduction  
to  
  the Microcontroller Binary Code },  
  journal = { Science of computer programming },  
  publisher = { Elsevier },  
  pages = { 100-118 },  
  volume = { 76 },  
  number = { 2 },  
  year = { 2011 },  
  address = { Amsterdam [u.a.] },  
  issn = { 0167-6423 },  
  doi = { 10.1016/j.scico.2010.03.006 },  
  typ = { PUB:(DE-HGF)16 },  
  reportid = { RWTH-CONV-062661 },  
  cin = { 122810 / 120000 },  
  url = { http://publications.rwth-aachen.de/record/186222 },  
}
```

[SNB+11]

## PDFBIB

Schlich, B., Noll, T., Brauer, J., and Brutschy, L., "Reduction of Interrupt Handler Executions for Model Checking Embedded Software", in *Proc. Hardware and software: verification and testing : 5th International Haifa Verification Conference, HCV 2009, Haifa, Israel, October 19-22, 2009 : revised selected papers / Kedar Namjoshi ... (eds.)*, Heidelberg [u.a.], 2011 in Lecture Notes in Computer Science, Springer.

# Reduction of Interrupt Handler Executions for Model Checking Embedded Software

## Bibtex entry :

```
@inproceedings { SNB+11,  
  author = { Schlich, Bastian and Noll, Thomas and Brauer, J{"o}rg  
and  
  Brutschy, Lucas },  
  title = { Reduction of Interrupt Handler Executions for Model
```

**Checking**

```

    Embedded Software },
    booktitle = { Hardware and software: verification and testing : 5th
        International Haifa Verification Conference, HCV 2009,
        Haifa, Israel, October 19-22, 2009 : revised selected papers
        / Kedar Namjoshi ... (eds.) },
    publisher = { Springer },
    series = { Lecture Notes in Computer Science },
    year = { 2011 },
    address = { Heidelberg [u.a.] },
    doi = { 10.1007/978-3-642-19237-1_5 },
    typ = { PUB:(DE-HGF)8 },
    reportid = { RWTH-CONV-187757 },
    cin = { 122810 / 121310 / 120000 },
    url = { http://publications.rwth-aachen.de/record/116214 },
}

```

[BBG+10]

[PDFBIB](#)

Biallas, S., Brauer, J., Gückel, D., and Kowalewski, S., "On-The-Fly Path Reduction", in *Proc. 4th International Workshop on Harnessing Theories for Tool Support in Software : TTSS'10 ; East China Normal University, Shanghai, China, November 15, 2010 ; Preliminary Proceedings / Eds.: Min Zhang and Volker Stolz*, Macau, 2010 in UNU-IIST Report, UNU-IIST, pp. 108-122.

## On-The-Fly Path Reduction

### Bibtex entry :

```

@inproceedings { BBG+10,
    author = { Biallas, Sebastian and Brauer, J{"o}rg and G{"u}ckel,
        Dominique and Kowalewski, Stefan },
    title = { On-The-Fly Path Reduction },
    booktitle = { 4th International Workshop on Harnessing Theories for
Tool
        Support in Software : TTSS'10 ; East China Normal
        University, Shanghai, China, November 15, 2010 ; Preliminary
        Proceedings / Eds.: Min Zhang and Volker Stolz },
    publisher = { UNU-IIST },
    pages = { 108-122 },
    series = { UNU-IIST Report },
    year = { 2010 },
    address = { Macau },
    typ = { PUB:(DE-HGF)8 },
    reportid = { RWTH-CONV-190152 },
    cin = { 122810 / 120000 },
    url = {
http://i.unu.edu/unu/u/publication/000/001/286/report444.pdf },
}

```

[BBK10]

[PDFBIB](#)

Biallas, S., Brauer, J., and Kowalewski, S., "Counterexample-Guided Abstraction Refinement for PLCs", in *Proc. 5th International Workshop on Systems Software Verification (SSV 2010), Vancouver, Canada, 2010*.

## Counterexample-Guided Abstraction Refinement for PLCs

### Bibtex entry :

```
@inproceedings { BBK10,  
  author = { Biallas, Sebastian and Brauer, J{"o}rg and Kowalewski,  
            Stefan },  
  title = { Counterexample-Guided Abstraction Refinement for PLCs },  
  booktitle = { 5th International Workshop on Systems Software  
Verification  
            (SSV 2010), Vancouver, Canada },  
  year = { 2010 },  
  typ = { PUB:(DE-HGF)8 },  
  reportid = { RWTH-CONV-189856 },  
  cin = { 122810 / 120000 },  
  url = {  
http://www.embedded.rwth-aachen.de/lib/exe/fetch.php?media=bib:bbk10.pdf  
  },  
}
```

[BK10]

[PDFBIB](#)

Brauer, J. and King, A., "Automatic Abstraction for Intervals using Boolean Formulae", in *Proc. Static analysis : 17th international symposium, SAS 2010, Perpignan, France, September 14-16, 2010 ; proceedings / Radhia Cousot; Matthieu Martel (eds.)*, Berlin [u.a.], 2010 in *Lecture notes in computer science*, Springer, pp. 167-183.

## Automatic Abstraction for Intervals using Boolean Formulae

### Bibtex entry :

```
@inproceedings { BK10,  
  author = { Brauer, J{"o}rg and King, Andy },  
  title = { Automatic Abstraction for Intervals using Boolean  
Formulae },  
  booktitle = { Static analysis : 17th international symposium, SAS  
2010,  
            Perpignan, France, September 14-16, 2010 ; proceedings /  
            Radhia Cousot; Matthieu Martel (eds.) },  
  publisher = { Springer },  
  pages = { 167-183 },  
  series = { Lecture notes in computer science },  
  year = { 2010 },
```

```
address = { Berlin [u.a.] },
doi = { 10.1007/978-3-642-15769-1_11 },
typ = { PUB:(DE-HGF)8 },
reportid = { RWTH-CONV-190302 },
cin = { 122810 / 120000 },
url = { http://publications.rwth-aachen.de/record/119140 },
}
```

[BKK+10]

[PDFBIB](#)

Brauer, J., Kamin, V., Kowalewski, S., and Noll, T., "Loop Refinement using Octagons and Satisfiability", in *Proc. SSV'10 : Proceedings of the 5th international conference on Systems software verification*, New York, NY, 2010, ACM, p. 9.

## Loop Refinement using Octagons and Satisfiability

### Bibtex entry :

```
@inproceedings { BKK+10,
  author = { Brauer, J{"o"}rg and Kamin, Volker and Kowalewski,
Stefan
  and Noll, Thomas },
  title = { Loop Refinement using Octagons and Satisfiability },
  booktitle = { SSV'10 : Proceedings of the 5th international
conference on
  Systems software verification },
  publisher = { ACM },
  pages = { 9 S. },
  year = { 2010 },
  address = { New York, NY },
  typ = { PUB:(DE-HGF)8 },
  reportid = { RWTH-CONV-196798 },
  cin = { 122810 / 121310 / 120000 },
  url = { http://dl.acm.org/citation.cfm?id=1929004&picked=prox },
}
```

[BKK10]

[PDFBIB](#)

Brauer, J., King, A., and Kowalewski, S., "Range Analysis of Microcontroller Code using Bit-Level Congruences", in *Proc. Formal methods for industrial critical systems : 15th international workshop, FMICS 2010, Antwerp, Belgium, September 20 - 21, 2010 ; proceedings / Stefan Kowalewski; Marco Roveri (eds.)*, Berlin [u.a.], 2010 in *Lecture notes in computer science*, Springer, pp. 82-98.

## Range Analysis of Microcontroller Code using Bit-Level Congruences

### Bibtex entry :

```
@inproceedings { BKK10,
```

```
author = { Brauer, J{"o}rg and King, Andy and Kowalewski, Stefan
},
title = { Range Analysis of Microcontroller Code using Bit-Level
Congruences },
booktitle = { Formal methods for industrial critical systems : 15th
international workshop, FMICS 2010, Antwerp, Belgium,
September 20 - 21, 2010 ; proceedings / Stefan Kowalewski;
Marco Roveri (eds.) },
publisher = { Springer },
pages = { 82-98 },
series = { Lecture notes in computer science },
year = { 2010 },
address = { Berlin [u.a.] },
doi = { 10.1007/978-3-642-15898-8_6 },
typ = { PUB:(DE-HGF)8 },
reportid = { RWTH-CONV-190303 },
cin = { 122810 / 120000 },
url = { http://publications.rwth-aachen.de/record/119141 },
}
```

[BNS10]

[PDFBIB](#)

Brauer, J., Noll, T., and Schlich, B., "Interval Analysis of Microcontroller Code using Abstract Interpretation of Hardware and Software", in *Proc. SCOPES '10 Proceedings of the 13th International Workshop on Software & Compilers for Embedded Systems : St. Goar, Germany - June 29-30, 2010*, New York, NY, 2010 in ACM Digital Library, ACM.

## Interval Analysis of Microcontroller Code using Abstract Interpretation of Hardware and Software

### Bibtex entry :

```
@inproceedings { BNS10,
author = { Brauer, J{"o}rg and Noll, Thomas and Schlich, Bastian
},
title = { Interval Analysis of Microcontroller Code using Abstract
Interpretation of Hardware and Software },
booktitle = { SCOPES '10 Proceedings of the 13th International
Workshop on
Software & Compilers for Embedded Systems : St. Goar,
Germany - June 29-30, 2010 },
publisher = { ACM },
series = { ACM Digital Library },
year = { 2010 },
address = { New York, NY },
doi = { 10.1145/1811212.1811216 },
typ = { PUB:(DE-HGF)8 },
reportid = { RWTH-CONV-191119 },
cin = { 122810 / 121310 / 120000 },
url = { http://publications.rwth-aachen.de/record/120063 },
}
```



}

[GBK10]

[PDFBIB](#)

Gückel, D., Brauer, J., and Kowalewski, S., "A System for Synthesizing Abstraction-Enabled Simulators for Binary Code Verification", in *Proc. 2010 International Symposium on Industrial Embedded Systems (SIES 2010) : Trento, Italy, 7 - 9 July 2010 / [University of Trento, Italy; IEEE; IES]*, Piscataway, NJ, 2010, IEEE, pp. 118-127.

## A System for Synthesizing Abstraction-Enabled Simulators for Binary Code Verification

### Bibtex entry :

```
@inproceedings { GBK10,
  author = { G{"u}ckel, Dominique and Brauer, J{"o}rg and
  Kowalewski,
    Stefan },
  title = { A System for Synthesizing Abstraction-Enabled Simulators
for
  Binary Code Verification },
  booktitle = { 2010 International Symposium on Industrial Embedded
Systems
  (SIES 2010) : Trento, Italy, 7 - 9 July 2010 / [University
of Trento, Italy; IEEE; IES] },
  publisher = { IEEE },
  pages = { 118-127 },
  year = { 2010 },
  address = { Piscataway, NJ },
  doi = { 10.1109/SIES.2010.5551382 },
  typ = { PUB:(DE-HGF)8 },
  reportid = { RWTH-CONV-190384 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/119226 },
}
```

[GSB+10]

[PDFBIB](#)

Gückel, D., Schlich, B., Brauer, J., and Kowalewski, S., "Synthesizing Simulators for Model Checking Microcontroller Binary", in *Proc. Proceedings of the 13th IEEE Symposium on Design and Diagnostics of Electronic Circuits and Systems : April 14-16, 2010, Vienna, Austria / Sponsored by IEEE Computer Society, Test Technology Techn. Council, In coop. with Dept. of Computer Engineering, Fac. of Informatics, Vienna Univ. of Techn., Piscataway, NJ, 2010, IEEE, pp. 313-316.*

## Synthesizing Simulators for Model Checking Microcontroller Binary

## Bibtex entry :

```
@inproceedings { GSB+10,  
  author = { G{"u}ckel, Dominique and Schlich, Bastian and Brauer,  
            J{"o}rg and Kowalewski, Stefan },  
  title = { Synthesizing Simulators for Model Checking  
Microcontroller  
Binary },  
  booktitle = { Proceedings of the 13th IEEE Symposium on Design and  
Diagnostics of Electronic Circuits and Systems : April  
14–16, 2010, Vienna, Austria / Sponsored by IEEE Computer  
Society, Test Technology Techn. Council, In coop. with Dept.  
of Computer Engineering, Fac. of Informatics, Vienna Univ.  
of Techn. },  
  publisher = { IEEE },  
  pages = { 313-316 },  
  year = { 2010 },  
  address = { Piscataway, NJ },  
  doi = { 10.1109/DDECS.2010.5491761 },  
  typ = { PUB:(DE-HGF)8 },  
  reportid = { RWTH-CONV-190385 },  
  cin = { 122810 / 120000 },  
  url = { http://publications.rwth-aachen.de/record/119227 },  
}
```

[RBH+10]

[PDFBIB](#)

Reinbacher, T., Brauer, J., Horauer, M., Steininger, A., and Kowalewski, S., "Test-Case Generation for Embedded Binary Code Using Abstract Interpretation", in *Proc. Sixth Doctoral Workshop on Mathematical and Engineering Methods in Computer Science (Selected Papers) (MEMICS 2010) [Elektronische Ressource] / Hrsg.: Ludek Matyska ; Michal Kozubek ; Tomáš Vojnar ; Pavel Zemčík ; David Antos*, Wadern, 2010 in OASIS - OpenAccess Series in Informatics, Schloss Dagstuhl - Leibniz-Zentrum für Informatik, pp. 101-108.

## Test-Case Generation for Embedded Binary Code Using Abstract Interpretation

### Bibtex entry :

```
@inproceedings { RBH+10,  
  author = { Reinbacher, Thomas and Brauer, J{"o}rg and Horauer,  
Martin  
and Steininger, Andreas and Kowalewski, Stefan },  
  title = { Test-Case Generation for Embedded Binary Code Using  
Abstract  
Interpretation },  
  booktitle = { Sixth Doctoral Workshop on Mathematical and  
Engineering  
Methods in Computer Science (Selected Papers) (MEMICS 2010)  
[Elektronische Ressource] / Hrsg.: Ludek Matyska ; Michal
```

```

    Kozubek ; Tomáš Vojnar ; Pavel Zemčík ; David Antos },
    publisher = { Schloss Dagstuhl - Leibniz-Zentrum für Informatik
},
    pages = { 101-108 },
    series = { OASICS - OpenAccess Series in Informatics },
    year = { 2010 },
    address = { Wadern },
    typ = { PUB:(DE-HGF)8 },
    reportid = { RWTH-CONV-196795 },
    cin = { 120000 / 122810 },
    url = { http://publications.rwth-aachen.de/record/126459 },
}

```

[BHS09]

[PDFBIB](#)

Brauer, J., Huuck, R., and Schlich, B., "Interprocedural pointer analysis in Goanna", *Electronic notes in theoretical computer science : ENTCS*, vol. 254, pp. 65-83, 2009

## Interprocedural pointer analysis in Goanna

### Bibtex entry :

```

@article { BHS09,
  author = { Brauer, Jörg and Huuck, Ralf and Schlich, Bastian },
  title = { Interprocedural pointer analysis in Goanna },
  journal = { Electronic notes in theoretical computer science :
ENTCS },
  publisher = { Elsevier Science },
  pages = { 65-83 },
  volume = { 254 },
  year = { 2009 },
  address = { Amsterdam [u.a.] },
  issn = { 1571-0661 },
  doi = { 10.1016/j.entcs.2009.09.060 },
  typ = { PUB:(DE-HGF)16 },
  reportid = { RWTH-CONV-013641 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/132532 },
}

```

[BSR+09]

[PDFBIB](#)

Brauer, J., Schlich, B., Reinbacher, T., and Kowalewski, S., "Stack bounds analysis of microcontroller assembly code", in *Proc. Embedded Systems Week 2009 : CODES+ISSS'09, CASES'09, EMSOFT'09 ; Proceedings of the 2009 international conference on Compilers, architecture, and synthesis for embedded systems ; 2009, Grenoble, France, October 11 - 16, 2009*, New York, NY, 2009, ACM Press.

# Stack bounds analysis of microcontroller assembly code

## Bibtex entry :

```
@inproceedings { BSR+09,  
  author = { Brauer, J{"o}rg and Schlich, Bastian and Reinbacher,  
Thomas  
  and Kowalewski, Stefan },  
  title = { Stack bounds analysis of microcontroller assembly code },  
  booktitle = { Embedded Systems Week 2009 : CODES+ISSS'09, CASES'09,  
EMSOFTE'09 ; Proceedings of the 2009 international  
  conference on Compilers, architecture, and synthesis for  
  embedded systems ; 2009, Grenoble, France, October 11 - 16,  
2009 },  
  publisher = { ACM Press },  
  year = { 2009 },  
  address = { New York, NY },  
  doi = { 10.1145/1631716.1631721 },  
  typ = { PUB:(DE-HGF)8 },  
  reportid = { RWTH-CONV-173253 },  
  cin = { 122810 / 120000 },  
  url = { http://publications.rwth-aachen.de/record/100433 },  
}
```

[RBH+09]

[PDFBIB](#)

Reinbacher, T., Brauer, J., Horauer, M., and Schlich, B., "Refining assembly code static analysis for the Intel MCS-51 microcontroller", in *Proc. 2009 IEEE International Symposium on Industrial Embedded Systems (SIES 2009) : Lausanne, Switzerland, 08 - 10 July 2009 / [sponsored by: IEEE Industrial Electronics Society (IES)]*, Piscataway, NJ, 2009, IEEE, pp. 161-170.

## Refining assembly code static analysis for the Intel MCS-51 microcontroller

### Bibtex entry :

```
@inproceedings { RBH+09,  
  author = { Reinbacher, Thomas and Brauer, J{"o}rg and Horauer,  
Martin  
  and Schlich, Bastian },  
  title = { Refining assembly code static analysis for the Intel  
MCS-51  
  microcontroller },  
  booktitle = { 2009 IEEE International Symposium on Industrial  
Embedded  
  Systems (SIES 2009) : Lausanne, Switzerland, 08 - 10 July  
2009 / [sponsored by: IEEE Industrial Electronics Society  
  (IES)] },  
  publisher = { IEEE },
```

```
pages = { 161-170 },
year = { 2009 },
address = { Piscataway, NJ },
doi = { 10.1109/SIES.2009.5196212 },
typ = { PUB:(DE-HGF)8 },
reportid = { RWTH-CONV-172391 },
cin = { 122810 / 120000 },
url = { http://publications.rwth-aachen.de/record/99425 },
}
```

[RHS+09]

[PDFBIB](#)

Reinbacher, T., Horauer, M., Schlich, B., Brauer, J., and Scheuer, F., "Model checking assembly code of an industrial knitting machine", in *Proc. Proceedings of the 2009 Fourth International Conference on Embedded and Multimedia Computing : EM-Com 2009 : [December 10-12, 2009, Jeju Island, Korea]*, Piscataway, NJ, 2009, IEEE, p. 8.

## Model checking assembly code of an industrial knitting machine

### Bibtex entry :

```
@inproceedings { RHS+09,
  author = { Reinbacher, Thomas and Horauer, Martin and Schlich,
    Bastian
    and Brauer, J{"o}rg and Scheuer, Florian },
  title = { Model checking assembly code of an industrial knitting
    machine },
  booktitle = { Proceedings of the 2009 Fourth International
    Conference on
    Embedded and Multimedia Computing : EM-Com 2009 : [December
    10-12, 2009, Jeju Island, Korea] },
  publisher = { IEEE },
  pages = { 8 S. },
  year = { 2009 },
  address = { Piscataway, NJ },
  doi = { 10.1109/EM-COM.2009.5402986 },
  typ = { PUB:(DE-HGF)8 },
  reportid = { RWTH-CONV-199048 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/129021 },
}
```

[SBW+09]

[PDFBIB](#)

Schlich, B., Brauer, J., Wernerus, J., and Kowalewski, S., "Direct Model Checking of PLC Programs in IL", in *Proc. Dependable Control of Discrete Systems (DCDS'09), Bari, Italy, 2009*, pp. 28-33.

## Direct Model Checking of {PLC} Programs in {IL}

### Bibtex entry :

```
@inproceedings { SBW+09,  
  author = { Schlich, Bastian and Brauer, J{"o}rg and Wernerus,  
  J{"o}rg  
    and Kowalewski, Stefan },  
  title = { Direct Model Checking of {PLC} Programs in {IL} },  
  booktitle = { Dependable Control of Discrete Systems (DCDS'09),  
  Bari,  
    Italy },  
  pages = { 28-33 },  
  year = { 2009 },  
  typ = { PUB:(DE-HGF)7 },  
  reportid = { RWTH-CONV-236337 },  
  cin = { 122810 / 120000 },  
  url = { http://publications.rwth-aachen.de/record/752318 },  
}
```

[HFS+08]

PDFBIB

Huuck, R., Fehnker, A., Seefried, S., and Brauer, J., "Goanna: syntactic software model checking"Berlin [u.a.]: Springer, 2008, vol. 5311, pp. 216-221.

## Goanna: syntactic software model checking

### Bibtex entry :

```
@inbook { HFS+08,  
  author = { Huuck, Ralf and Fehnker, Ansgar and Seefried, Sean and  
  Brauer, J{"o}rg },  
  title = { Goanna: syntactic software model checking },  
  booktitle = { Automated technology for verification and analysis :  
  6th  
    international symposium, ATVA 2008, Seoul, Korea, October 20  
    - 23, 2008 ; proceedings / Sungdeok (Steve) Cha; Jin-Young  
    Choi; Moonzoo Kim; Insup Lee; Mahesh Viswanathan (eds.) },  
  publisher = { Springer },  
  pages = { 216-221 },  
  volume = { 5311 },  
  series = { Lecture notes in computer science },  
  year = { 2008 },  
  address = { Berlin [u.a.] },  
  organization = { 6th International Symposium on Automated  
  Technology for  
    Verification and Analysis, Seoul (South Korea), 2008-10-20 -  
    2008-10-23 },  
  doi = { 10.1007/978-3-540-88387-6_17 },  
  typ = { PUB:(DE-HGF)7 },
```

```
reportid = { RWTH-CONV-095469 },  
}
```

## Invited Talks

- Existential Quantification as Incremental SAT. Technical University of Denmark, Copenhagen. 10-06-2011.
- Automatic Abstraction for Binary Code Verification. Aalborg University, Denmark. 13-04-2011.
- Automatic Abstraction for Intervals using Boolean Formula. Technical University of Munich, Germany. 14-05-2010.
- Static Analysis in [mc]square. University of Applied Sciences FH Technikum Vienna, Austria. 31-03-2009.

## Teaching

- Winter semester 2010/2011
  - [Formal Methods for Embedded Systems](#) (Lecture)
- Summer semester 2010
  - [Seminar: Programmanalyse](#) (Seminar)
- Winter semester 2009/2010
  - [Formal Methods for Embedded Systems](#) (Lecture)
  - [Verification and Program Analysis](#) (Seminar)
- Summer semester 2009
  - [Applying Formal Verification Methods to Embedded Systems](#) (Seminar)
- Winter semester 2008/2009
  - [Static Analysis of Embedded Systems Software](#) (Seminar)

From:  
<https://www.embedded.rwth-aachen.de/> - **Informatik 11 - Embedded Software**

Permanent link:  
<https://www.embedded.rwth-aachen.de/doku.php?id=en:lehrstuhl:mitarbeiter:brauer>

Last update: **2013/10/14 16:47**

