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Open theses

At the moment, no explicitly formulated, open topics are available. However, if you are interested in formal methods, we can meet up and draft a suitable bachelor's or a master's thesis topic. Your own suggestions are welcome as well.

Teaching

| Semester | Title | Type |
|----------|--|------|
| WS 19/20 | Proseminar: Grundlagen eingebetteter Systeme | S |
| SS 19 | Seminar: Ausgesuchte Themen zur Eingebetteten Software | S |
| | Proseminar: Grundlagen eingebetteter Systeme | S |
| WS 18/19 | Formale Methoden für Steuerungssoftware | L |
| | Formale und semiformale Methoden für eingebettete Software | S |
| SS 18 | Formale und semiformale Methoden für eingebettete Software | S |

| Semester | Title | Type |
|----------|--|------|
| WS 17/18 | Formale Methoden für Steuerungssoftware | L |
| | Formale und semiformale Methoden für eingebettete Software | S |
| SS 17 | Formale und semiformale Methoden für eingebettete Software | S |
| WS 16/17 | Formale Methoden für Steuerungssoftware | L |
| SS 16 | Formale und semiformale Methoden für eingebettete Software | S |
| WS 15/16 | Formale Methoden für Steuerungssoftware | L |
| | Formale und semiformale Methoden für eingebettete Software | S |
| SS 15 | Formale und semiformale Methoden für eingebettete Software | S |

Publications

[Boh21]

[PDFBIB](#)

Bohlender, D., "Symbolic methods for formal verification of industrial control software", PhD Thesis, Aachen, 2021.

Symbolic methods for formal verification of industrial control software

Bibtex entry :

```
@phdthesis { Boh21,  
  author = { Bohlender, Dimitri },  
  othercontributors = { Kowalewski, Stefan and Hermanns, Holger },  
  title = { Symbolic methods for formal verification of industrial  
    control software },  
  publisher = { RWTH Aachen University },  
  school = { RWTH Aachen University },  
  pages = { 1 Online-Ressource : Illustrationen, Diagramme },  
  series = { Aachener Informatik-Berichte },  
  year = { 2021 },  
  address = { Aachen },  
  doi = { 10.18154/RWTH-2021-10633 },  
  typ = { PUB:(DE-HGF)11 },  
  reportid = { RWTH-2021-10633 },  
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  url = {  
http://publications.rwth-aachen.de/record/835546/files/835546.pdf },  
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[GSB+20]

[PDFBIB](#)

Grochowski, M., Simon, H., Bohlender, D., Kowalewski, S., Löcklin, A., Müller, T., Jazdi, N., Zeller, A., and Weyrich, M., "Formale Methoden für rekonfigurierbare cyber-physische Systeme in der Produktion", *Automatisierungstechnik*, vol. 68, iss. 1, pp. 3-14, 2020

Formale Methoden für rekonfigurierbare cyber-physische Systeme in der Produktion

Bibtex entry :

```
@article { GSB+20,
  author = { Grochowski, Marco and Simon, Hendrik and Bohlender,
Dimitri
    and Kowalewski, Stefan and L{"o}cklin, Andreas and
M{"u}ller, Timo and Jazdi, Nasser and Zeller, Andreas and
Weyrich, Michael },
  title = { Formale Methoden f{"u}r rekonfigurierbare cyber-
physische
    Systeme in der Produktion },
  journal = { Automatisierungstechnik },
  publisher = { De Gruyter },
  pages = { 3-14 },
  volume = { 68 },
  number = { 1 },
  year = { 2020 },
  address = { Berlin },
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  doi = { 10.1515/auto-2019-0115 },
  typ = { PUB:(DE-HGF)16 },
  reportid = { RWTH-2019-12214 },
  cin = { 122810 / 120000 },
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[BCK+19]

[PDFBIB](#)

Bohlender, D., Chiyah Garcia, F. J., Köhl, M., Menghi, C., and Wortmann, A., "On Explainability and its Characterization", , pp. 4-7, 2019

On Explainability and its Characterization

Bibtex entry :

```
@article { BCK+19,
  author = { Bohlender, Dimitri and Chiyah Garcia, Francisco J. and
K{"o}hl, Maximilian and Menghi, Claudio and Wortmann,
  Andreas },
  title = { On Explainability and its Characterization },
  pages = { 4-7 },
  year = { 2019 },
  organization = { GI Dagstuhl Seminar 19023 on Explainable Software
for
  Cyber-Physical Systems, Dagstuhl (Germany), 2019-01-06 -
  2019-01-11 },
  doi = { 10.18154/RWTH-2020-01625 },
  typ = { PUB:(DE-HGF)25 },
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reportid = { RWTH-2020-01625 },  
cin = { 122810 / 120000 / 121510 },  
url = { https://arxiv.org/pdf/1904.11851.pdf#page=9 },  
}
```

[BK19]

[PDFBIB](#)

Bohlender, D. and Kowalewski, S., "Leveraging Horn clause solving for compositional verification of PLC software", *Discrete event dynamic systems*, vol. 30, pp. 1-24, 2019

Leveraging Horn clause solving for compositional verification of PLC software

Bibtex entry :

```
@article { BK19,  
  author = { Bohlender, Dimitri and Kowalewski, Stefan },  
  title = { Leveraging Horn clause solving for compositional  
    verification of PLC software },  
  journal = { Discrete event dynamic systems },  
  publisher = { Springer Science + Business Media B.V },  
  pages = { 1-24 },  
  volume = { 30 },  
  year = { 2019 },  
  address = { Dordrecht [u.a.] },  
  issn = { 1573-7594 },  
  doi = { 10.1007/s10626-019-00296-8 },  
  typ = { PUB:(DE-HGF)16 },  
  reportid = { RWTH-2019-12207 },  
  cin = { 122810 / 120000 },  
  url = { http://publications.rwth-aachen.de/record/775404 },  
}
```

[BK19a]

[PDFBIB](#)

Bohlender, D. and Köhl, M. A., "Towards a Characterization of Explainable Systems", , 2019

Towards a Characterization of Explainable Systems

Bibtex entry :

```
@article { BK19a,  
  author = { Bohlender, Dimitri and Köhl, Maximilian A. },  
  title = { Towards a Characterization of Explainable Systems },  
  year = { 2019 },  
  typ = { PUB:(DE-HGF)25 },  
  reportid = { RWTH-2020-01624 },  
  cin = { 122810 / 120000 },  
  url = {  
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https://www.semanticscholar.org/paper/Towards-a-Characterization-of-Exp
lainable-Systems-Bohlender-
K%C3%B6hl/b3516a71fed895a1a88b7d9842eca41c0fb48b7d },
}
```

[KBL+19]

[PDFBIB](#)

Köhl, M. A., Baum, K., Langer, M., Oster, D., Speith, T., and Bohlender, D., "Explainability as a Non-Functional Requirement", in *Proc. 2019 IEEE 27th International Requirements Engineering Conference : 23-27 September 2019, Jeju Island, South Korea : proceedings / editors: Daniela Damian and Anna Perini (Program Chairs), Seok-Won Lee (General Chair)*, Piscataway, JN, 2019, IEEE, pp. 363-368.

Explainability as a Non-Functional Requirement

Bibtex entry :

```
@inproceedings { KBL+19,
  author = { K{"o}hl, Maximilian A. and Baum, Kevin and Langer,
Markus
  and Oster, Daniel and Speith, Timo and Bohlender, Dimitri },
  title = { Explainability as a Non-Functional Requirement },
  booktitle = { 2019 IEEE 27th International Requirements Engineering
Conference : 23-27 September 2019, Jeju Island, South Korea
: proceedings / editors: Daniela Damian and Anna Perini
(Program Chairs), Seok-Won Lee (General Chair) },
  publisher = { IEEE },
  pages = { 363-368 },
  year = { 2019 },
  address = { Piscataway, JN },
  organization = { IEEE 27. International Requirements Engineering
Conference,
Jeju Island (South Korea), 2019-09-23 - 2019-09-27 },
  doi = { 10.1109/RE.2019.00046 },
  typ = { PUB:(DE-HGF)7 },
  reportid = { RWTH-2019-12206 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/775403 },
}
```

[BHK18]

[PDFBIB](#)

Bohlender, D., Hamm, D., and Kowalewski, S., "Cycle-Bounded Model Checking of PLC Software via Dynamic Large-Block Encoding", in *Proc. Applied computing 2018 : the 33rd Annual ACM Symposium on Applied Computing : Pau, France, April 9-13, 2018 / sponsored by: ACM Special Interest Group on Applied Computing ; conference chairs: Hisham M. Haddad (Kennesaw State University, USA), Roger L. Wainwright (University of Tulsa, USA), Richard Chbeir (University of Pau & Pays Adour, France)*, New York, NY, 2018, ACM, pp. 1891-1898.

Cycle-Bounded Model Checking of PLC Software via Dynamic Large-Block Encoding

Bibtex entry :

```
@inproceedings { BHK18,  
  author = { Bohlender, Dimitri and Hamm, Daniel and Kowalewski,  
Stefan },  
  title = { Cycle-Bounded Model Checking of PLC Software via Dynamic  
Large-Block Encoding },  
  booktitle = { Applied computing 2018 : the 33rd Annual ACM  
Symposium on  
Applied Computing : Pau, France, April 9-13, 2018 /  
sponsored by: ACM Special Interest Group on Applied  
Computing ; conference chairs: Hisham M. Haddad (Kennesaw  
State University, USA), Roger L. Wainwright (University of  
Tulsa, USA), Richard Chbeir (University of Pau & Pays Adour,  
France) },  
  publisher = { ACM },  
  pages = { 1891-1898 },  
  year = { 2018 },  
  address = { New York, NY },  
  organization = { 33. ACM Symposium on Applied Computing, Pau  
(France),  
2018-04-09 - 2018-04-13 },  
  doi = { 10.1145/3167132.3167334 },  
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  url = { http://publications.rwth-aachen.de/record/752221 },  
}
```

[BK18]

[PDFBIB](#)

Bohlender, D. and Kowalewski, S., "Compositional Verification of PLC Software using Horn Clauses and Mode Abstraction", *IFAC-PapersOnLine*, vol. 51, iss. 7, pp. 428-433, 2018

Compositional Verification of PLC Software using Horn Clauses and Mode Abstraction

Bibtex entry :

```
@article { BK18,  
  author = { Bohlender, Dimitri and Kowalewski, Stefan },  
  title = { Compositional Verification of PLC Software using Horn  
Clauses and Mode Abstraction },  
  journal = { IFAC-PapersOnLine },  
  pages = { 428-433 },
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volume = { 51 },
number = { 7 },
year = { 2018 },
address = { Laxenburg },
issn = { 2405-8963 },
organization = { 14. IFAC International Workshop on Discrete Event
Systems,
    Castellammare di Stabia (Italy), 2018-05-30 - 2018-06-01 },
doi = { 10.1016/j.ifacol.2018.06.336 },
typ = { PUB:(DE-HGF)16 },
reportid = { RWTH-2018-227071 },
cin = { 122810 / 120000 },
url = { http://publications.rwth-aachen.de/record/730763 },
}

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[BK18a]

[PDFBIB](#)

Bohlender, D. and Kowalewski, S., "Design and Verification of Restart-Robust Industrial Control Software", in *Proc. Integrated formal methods : 14th International Conference, IFM 2018, Maynooth, Ireland, September 5-7, 2018 : proceedings / Carlo A. Furia, Kirsten Winter (eds.)*, Cham, 2018 in Lecture notes in computer science, Springer, pp. 47-68.

Design and Verification of Restart-Robust Industrial Control Software

Bibtex entry :

```

@inproceedings { BK18a,
    author = { Bohlender, Dimitri and Kowalewski, Stefan },
    title = { Design and Verification of Restart-Robust Industrial
Control
    Software },
    booktitle = { Integrated formal methods : 14th International
Conference,
    IFM 2018, Maynooth, Ireland, September 5-7, 2018 :
    proceedings / Carlo A. Furia, Kirsten Winter (eds.) },
    publisher = { Springer },
    pages = { 47-68 },
    series = { Lecture notes in computer science },
    year = { 2018 },
    address = { Cham },
    organization = { 14. International Conference on Integrated Formal
Methods,
    Maynooth (Ireland), 2018-09-05 - 2018-09-07 },
    doi = { 10.1007/978-3-319-98938-9_4 },
    typ = { PUB:(DE-HGF)7 },
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    cin = { 122810 / 120000 },
    url = { http://publications.rwth-aachen.de/record/752219 },
}

```

[UVS+17]

[PDFBIB](#)

Ulewicz, S., Vogel-Heuser, B., Simon, H., Bohlender, D., Obster, M., and Kowalewski, S., "A priori test coverage estimation for automated production systems : Using generated behavior models for coverage calculation", in *Proc. 2017 22nd IEEE International Conference on Emerging Technologies and Factory Automation : September 12-15, 2017, Limassol, Cyprus / ABB, IEEE, IES, University of Cyprus, Piscataway, NJ, 2017, IEEE, p. 4.*

A priori test coverage estimation for automated production systems : Using generated behavior models for coverage calculation

Bibtex entry :

```
@inproceedings { UVS+17,  
  author = { Ulewicz, Sebastian and Vogel-Heuser, Birgit and Simon,  
            Hendrik and Bohlender, Dimitri and Obster, Mathias and  
            Kowalewski, Stefan },  
  title = { A priori test coverage estimation for automated  
production  
            systems : Using generated behavior models for coverage  
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  booktitle = { 2017 22nd IEEE International Conference on Emerging  
            Technologies and Factory Automation : September 12-15, 2017,  
            Limassol, Cyprus / ABB, IEEE, IES, University of Cyprus },  
  publisher = { IEEE },  
  pages = { 4 Seiten },  
  year = { 2017 },  
  address = { Piscataway, NJ },  
  organization = { 22. IEEE International Conference on Emerging  
Technologies  
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  doi = { 10.1109/ETFA.2017.8247704 },  
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}
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[BSF+16]

[PDFBIB](#)

Bohlender, D., Simon, H., Friedrich, N., Kowalewski, S., and Hauck-Stattelmann, S., "Concolic test generation for PLC programs using coverage metrics", in *Proc. 2016 13th International Workshop on Discrete Event Systems (WODES) : May 30-June 1, 2016, Xi'an, China / edited by Christos G. Cassandras, Alessandro Giua, Zhiwu Li ; sponsored by IEEE - Control Systems Society, Piscataway, NJ, 2016, IEEE, pp. 432-437.*

Concolic test generation for PLC programs using coverage metrics

Bibtex entry :

```
@inproceedings { BSF+16,
  author = { Bohlender, Dimitri and Simon, Hendrik and Friedrich, Nico
    and Kowalewski, Stefan and Hauck-Stattelmann, Stefan },
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  booktitle = { 2016 13th International Workshop on Discrete Event Systems
    (WODES) : May 30-June 1, 2016, Xi'an, China / edited by Christos G. Cassandras, Alessandro Giua, Zhiwu Li ; sponsored by IEEE - Control Systems Society },
  publisher = { IEEE },
  pages = { 432-437 },
  year = { 2016 },
  address = { Piscataway, NJ },
  organization = { 13. International Workshop on Discrete Event Systems, Xi'an
    (Peoples R China), 2016-05-30 - 2016-06-01 },
  doi = { 10.1109/WODES.2016.7497884 },
  typ = { PUB:(DE-HGF)7 },
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[BSK+16]

[PDFBIB](#)

Bohlender, D., Simon, H., Kowalewski, S., and Hauck-Stattelmann, S., "Symbolische Ausführung zum Testen von SPS-Programmen", in *Proc. Automation 2016 : secure & reliable in the digital world : 17. Branchentreff der Mess- und Automatisierungstechnik : Baden-Baden, 07. und 08. Juni 2016 / VDI/VDE Mess- und Automatisierungstechnik*, Düsseldorf, 2016 in VDI-Berichte, VDI Verlag GmbH, pp. 13-14.

Symbolische Ausführung zum Testen von SPS-Programmen

Bibtex entry :

```
@inproceedings { BSK+16,
  author = { Bohlender, Dimitri and Simon, Hendrik and Kowalewski, Stefan
    and Hauck-Stattelmann, S. },
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  },
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booktitle = { Automation 2016 : secure & reliable in the digital
world :
    17. Branchentreff der Mess- und Automatisierungstechnik :
    Baden-Baden, 07. und 08. Juni 2016 / VDI/VDE Mess- und
    Automatisierungstechnik },
publisher = { VDI Verlag GmbH },
pages = { 13-14 },
series = { VDI-Berichte },
year = { 2016 },
address = { D{"u}seldorf },
organization = { 17. Branchentreff der Mess- und
Automatisierungstechnik,
    Baden-Baden (Germany), 2016-06-07 - 2016-06-08 },
typ = { PUB:(DE-HGF)7 },
reportid = { RWTH-2016-12035 },
cin = { 122810 / 120000 },
url = { http://publications.rwth-aachen.de/record/680852 },
}
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[BSK16]

[PDFBIB](#)

Bohlender, D., Simon, H., and Kowalewski, S., "Symbolic verification of PLC safety-applications based on PLCopen automata", in *Proc. MBMV 2016 : 19. GI/ITG/GMM-Workshop "Methoden und Beschreibungssprachen zur Modellierung und Verifikation von Schaltungen und Systemen" : Albert-Ludwigs-Universität Freiburg im Breisgau 1.-2. März 2016 / Ralf Wimmer (Herausgeber)*, Freiburg im Breisgau, 2016, Albert-Ludwigs-Universität, pp. 33-45.

Symbolic verification of PLC safety-applications based on PLCopen automata

Bibtex entry :

```
@inproceedings { BSK16,
    author = { Bohlender, Dimitri and Simon, Hendrik and Kowalewski,
Stefan },
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    booktitle = { MBMV 2016 : 19. GI/ITG/GMM-Workshop "Methoden und
    Beschreibungssprachen zur Modellierung und Verifikation von
    Schaltungen und Systemen" : Albert-Ludwigs-Universit{"a}t
    Freiburg im Breisgau 1.-2. M{"a}rz 2016 / Ralf Wimmer
    (Herausgeber) },
    publisher = { Albert-Ludwigs-Universit{"a}t },
    pages = { 33-45 },
    year = { 2016 },
    address = { Freiburg im Breisgau },
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Beschreibungssprachen
    zur Modellierung und Verifikation von Schaltungen und
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Systemen", Freiburg im Breisgau (Germany), 2016-03-01 -
2016-03-02 },
doi = { 10.6094/UNIFR/10636 },
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cin = { 122810 / 120000 },
url = {
http://publications.rwth-aachen.de/record/573821/files/573821.pdf },
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[BBJKNN14]

PDFBIB

Bohlender, D., Bruintjes, H., Junges, S., Katelaan, J., Nguyen, V. Y., and Noll, T., "A Review of Statistical Model Checking Pitfalls on Real-Time Stochastic Models", in *Proc. Leveraging Applications of Formal Methods, Verification and Validation. Specialized Techniques and Applications - 6th International Symposium, ISoLA 2014, Imperial, Corfu, Greece, October 8-11, 2014, Proceedings, Part {II}*, 2014, IEEE, pp. 177-192.

A Review of Statistical Model Checking Pitfalls on Real-Time Stochastic Models

Bibtex entry :

```

@inproceedings { BBJKNN14,
  author = { Dimitri Bohlender and Harold Bruintjes and Sebastian
Junges
and Jens Katelaan and Viet Yen Nguyen and Thomas Noll },
  title = { A Review of Statistical Model Checking Pitfalls on Real-
Time
Stochastic Models },
  booktitle = { Leveraging Applications of Formal Methods,
Verification and
Validation. Specialized Techniques and Applications - 6th
International Symposium, ISoLA 2014, Imperial, Corfu,
Greece, October 8-11, 2014, Proceedings, Part {II} },
  pages = { 177--192 },
  publisher = { IEEE },
  publishedas = { Druck Online },
  isbn = { 978-3-662-45231-8 },
  language = { eng },
  year = { 2014 },
  timestamp = { Mon, 29 Sep 2014 11:09:02 +0200 },
  illkey = { conference },
  for_reporting_period = { 2014 },
}

```

[BBK13]

PDFBIB

Biallas, S., Bohlender, D., and Kowalewski, S., "Boolean and Modular Abstractions for Programmable Logic Controllers", in *Proc. Dependable Control of Discrete Systems : DCDS13*. -

Vol. 4, P. 1, Laxenburg, 2013, IFAC, pp. 97-102.

Boolean and Modular Abstractions for Programmable Logic Controllers

Bibtex entry :

```
@inproceedings { BBK13,  
  author = { Biallas, Sebastian and Bohlender, Dimitri and  
  Kowalewski,  
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  title = { Boolean and Modular Abstractions for Programmable Logic  
    Controllers },  
  booktitle = { Dependable Control of Discrete Systems : DCDS13. -  
  Vol. 4,  
    P. 1 },  
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  pages = { 97-102 },  
  year = { 2013 },  
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  organization = { Dependable Control of Discrete Systems },  
  doi = { 10.3182/20130904-3-UK-4041.00011 },  
  typ = { PUB:(DE-HGF)8 },  
  reportid = { RWTH-CONV-203363 },  
  cin = { 120000 / 122810 },  
  url = { http://publications.rwth-aachen.de/record/225788 },  
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<https://www.embedded.rwth-aachen.de/> - **Informatik 11 - Embedded Software**

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

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