

Majid Zamani (CV)

ASSOCIATE PROFESSOR

Computer Science Department
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GOOGLE SCHOLAR PAGE: <https://bit.ly/375zwJL>

Academic Positions

- Aug'22–Now **Associate Professor**, *University of Colorado Boulder, USA*
Department of Computer Science
- Jan'19–
Aug'22 **Assistant Professor**, *University of Colorado Boulder, USA*
Department of Computer Science
- Feb'19–Now **Part-time Professor**, *Ludwig Maximilian University of Munich, Germany*
Department of Computer Science
- May'14–
Jan'19 **Assistant Professor**, *Technical University of Munich, Germany*
Department of Electrical and Computer Engineering
- Dec'13–
May'14 **Assistant Professor**, *Delft University of Technology, The Netherlands*
Department of Design Engineering, Mechatronic Design
- Sep'12–
Dec'13 **Postdoctoral Researcher**, *Delft University of Technology, The Netherlands*
Delft Center for Systems and Control

Academic Degrees

- Sep'12 **Ph.D.** in Electrical Engineering, *University of California, Los Angeles (UCLA), USA*
Thesis: *Control of cyber-physical systems using incremental properties of physical systems*
- Sep'12 **Master of Arts** in Mathematics, *University of California, Los Angeles, USA*
- Nov'07 **Master of Science** in Electrical Engineering, *Sharif University of Technology, Iran*
- Sep'05 **Bachelor of Science** in Electrical Engineering, *Isfahan University of Technology, Iran*
(*First Class Honors*)

Research Interests

1.

2. Correct-by-construction synthesis of (stochastic) hybrid systems
3. Secure-by-construction synthesis of (stochastic) hybrid systems
4. Compositional analysis and synthesis of interconnected systems
5. Formal methods approaches to robotic applications and autonomous systems
6. Information-based control

Honours & Awards

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| 2023 | European Research Council (ERC) Proof of Concept Grant (€150 000) |
| 2023 | IEEE CSS George S. Axelby Outstanding Paper Award |
| 2022 | NSF CAREER Award (\$532 278) |
| 2021 | IEEE TC discrete event systems outstanding student paper prize (as co-author) |
| 2021 | Best repeatability prize at the 7th IFAC Conference on Analysis and Design of Hybrid Systems (as advisor) |
| 2021 | Top two finalists for the best poster/demo award at the 24th ACM International Conference on Hybrid Systems: Computation and Control (as advisor) |
| 2020 | The best poster/demo award at the 23rd ACM International Conference on Hybrid Systems: Computation and Control (as advisor) |
| 2019 | Top three finalists for the young author award at the IFAC Symposium on Large Scale Complex Systems (as advisor) |
| 2018 | European Research Council (ERC) Starting Grant (€1 500 000) (https://erc.europa.eu) |
| 2017 | Top four finalist for the best student paper award at the 4th Indian Control Conference (as advisor) |
| 2016 | Senior member of IEEE |
| 2012 | Top three finalist for the best paper award at the International Conference on Embedded Software (as the main author) |
| 2008-2009 | Recipient of several Graduate Fellowships at UCLA |
| 2006 | Recipient of a scientific elite status by the Iran's National Elites Foundation (http://en.bmn.ir) |
| 2005 | First rank in the B.Sc. program |
| 2005 | Second place at the worldwide RoboCup soccer competition in Japan |

Teaching

UNIVERSITY OF COLORADO BOULDER, USA

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|-----------|---|
| Fall'23 | <i>Foundations of Autonomous Systems (CSCI-5854)</i> |
| Spring'23 | <i>Advanced Data Science (CSCI 4022)</i> |
| Fall'22 | <i>Foundations of Autonomous Systems (CSCI-5854)</i> |
| Spring'21 | <i>Linear Algebra with Computer Science Applications (CSCI-2820)</i> |
| Fall'20 | <i>Foundations of Autonomous Systems (CSCI-5854)</i> |
| Spring'20 | <i>Linear Algebra with Computer Science Applications (CSCI-2820)</i> (1st time teaching the course) |
| Fall'19 | <i>Foundations of Autonomous Systems (CSCI-5854)</i> (New course) |

TECHNICAL UNIVERSITY OF MUNICH, GERMANY

Spring'18	<i>Control Theory</i>
Spring'18	<i>Advanced Seminar on Cyber-Physical Systems</i>
Winter'17	<i>Analysis and Control of Nonlinear Systems</i> (New course)
Winter'17	<i>Advanced Seminar on Cyber-Physical Systems</i> (New seminar)
Spring'17	<i>Control Theory</i>
Winter'16	<i>Modeling and Verification of Embedded Systems</i>
Winter'16	<i>Formal Methods Laboratory</i> (New lab)
Spring'16	<i>Control Theory</i>
Winter'15	<i>Modeling and Verification of Embedded Systems</i>
Spring'15	<i>Control Theory</i> (1st time teaching the course)
Winter'14	<i>Modeling and Verification of Embedded Systems</i> (1st time teaching the course, one of the two largest M.Sc. courses in the ECE department)

DELFT UNIVERSITY OF TECHNOLOGY, THE NETHERLANDS

Winter'14	<i>Mechatronic</i> (New course)
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TEACHING ASSISTANT

University of California, Los Angeles, USA

Spring'12	<i>Introduction to Stochastic Processes</i>
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Sharif University of Technology, Iran

Fall'06	<i>Digital and Nonlinear Control</i>
Spring'07	<i>Linear Control</i>

Mentoring

POSTDOCS

UNIVERSITY OF COLORADO BOULDER

Oct'23–now	Bingzhuo Zhong
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PHD STUDENTS

UNIVERSITY OF COLORADO BOULDER

Jan'23–now	Felipe Galarza Jimenez
Aug'22–now	Alireza Nadali
Aug'22–now	Daniel Ajeleye
Jan'21–now	Vishnu Murali (jointly supervised with Prof. Ashutosh Trivedi)

LUDWIG MAXIMILIAN AND TECHNICAL UNIVERSITY OF MUNICH

May'16–now Asad Awan

UNDERGRADUATE STUDENTS

UNIVERSITY OF COLORADO BOULDER

Sep'23–now Ellina Kim, Ranjan Sigdel, Priya Patel

- Work on a robotic platform which allows for systematic generation of motion planning strategies in real-time for AWS DeepRacer robots.

Past Members

POSTDOCS AT CU BOULDER

Dr. Mahendra Singh Tomar (now an Assistant Professor at the Birla Institute Of Technology And Science, India)

POSTDOCS AT LUDWIG MAXIMILIAN UNIVERSITY OF MUNICH

Dr. Christoph Kawan (now senior developer at InMach GmbH), Dr. Navid Noroozi (now senior system engineer at SIGNON), Dr. Abolfazl Lavaei (now *Assistant Professor* at Newcastle University, UK)

POSTDOCS AT TECHNICAL UNIVERSITY OF MUNICH

Dr. Mohammad Al Khatib (now postdoc at TU Kaiserslautern, Germany), Dr. Matthias Rungger (now at EPO Munich, Germany), Dr. Kuize Zhang (now *Assistant Professor* at University of Surrey, UK)

PHD STUDENTS AT LUDWIG MAXIMILIAN UNIVERSITY OF MUNICH

Ali Salamati, Mahathi Anand (now postdoc at University of Stuttgart), Niloofar Jahanshahi

PHD STUDENTS AT TECHNICAL UNIVERSITY OF MUNICH

Bingzhuo Zhong (now postdoc at CU Boulder), Ameneh Nejati (now postdoc at MPI and as of January 2024 *Assistant Professor* at Newcastle University, UK), Siyuan Liu (now postdoc at KTH, Sweden), Mahmoud Khaled (now at Argo AI, Germany), Mahendra Singh Tomar (now an Assistant Professor at the Birla Institute Of Technology And Science, India), Pushpak Jagtap (now an *Assistant Professor* at Robert Bosch Center for Cyber-Physical System in Indian Institute of Science, India), Abdalla Swikir (now postdoc at TU Munich, Germany), Abolfazl Lavaei (now *Assistant Professor* at Newcastle University, UK)

MASTER STUDENTS AT TECHNICAL UNIVERSITY OF MUNICH

Mohamed Ben Slimane, Thomas Sebastian Gabler, Valentin Florian Hiltl, Yassine Hamza, Rafif Hassis, Susanne Riemann, Said Ben Bouzid, Armin Pribbernow, Simeon Nikolov, Mirco Theile (Now PhD at TUM), Frederik Kunik, Sebastian Käs, Pantelis Vlachas (Now PhD at ETHZ), Renan Derouet (intern), Christian Berg (intern), Xue Chuanqi, Alexander Steidle, Anastasios Rigas, Martin Wünsch, Maha Khalifa

BACHELOR STUDENTS AT CU BOULDER

Madelyn Weber

BACHELOR STUDENTS AT TECHNICAL UNIVERSITY OF MUNICH

Abhinav Himanshu (DAAD intern, now MSc at GATECH), Aneesh Dahiya (DAAD intern, now MSc at ETHZ), Loo Wei Jing, Nian Soon Sim, Nur Hanis Samad, Jian How Leon Low, Si Min Jasmine Leong, Yohannes Thiotiras Kwee, Wei Jun Gordon Guay, Michael Dabic, Vigneshram Krishnamoorthy (DAAD intern, now MSc at CMU), Akhil Ram (DAAD intern), Himanshi Yadav (DAAD intern, now MSc at CMU), Gregor Riemenschneider, Rafif Hassis, Ahmed Walid Abid, Adrian Mitschke, Kacem Hariz (intern), Monimoy Bujarbaruah (DAAD intern, now PhD at UC Berkeley), Kadiri Manasa (DAAD intern, now MSc at GATECH), Ishan Patil (DAAD intern, now MSc at Stanford), Anmol Jain (DAAD intern), Charan Kilari (intern, now MSc at USC)

MASTER STUDENTS AT DELFT UNIVERSITY OF TECHNOLOGY

Marco de Gier

Fundings & Grants

Total acquired funding is around: **\$26.18M**

- Funding from US sources (2019–Now): **\$8.3M**
- Funding from EU sources (2015–Now): **\$17.88M**

Total funding allocated to **M. Zamani** is around: **\$7.08M**

- Funding from US sources (2019–Now): **\$2.4M**
- Funding from EU sources (2015–Now): **\$4.68M**

UNIVERSITY OF COLORADO BOULDER

ACQUIRED:

2022

NSF CPS Frontier grant on “*Computation-Aware Algorithmic Design for Cyber-Physical Systems*”

- Role: Co-PI, joint with Ricardo Sanfelice (University of California Santa Cruz, lead PI), Murat Arcaç (University of California Berkeley, Co-PI), Linh Thi Xuan Phan (University of Pennsylvania, Co-PI), and Jonathan Sprinkle (University of Arizona, Co-PI)
 - Total funding: \$5 758 472 (**My Share:** \$878 426)
 - Duration: 1/1/2022 – 12/30/2026
- 2022 NSF CAREER award on “A Data-Driven Approach for Verification and Control of Cyber-Physical Systems”
- Role: Sole PI
 - Total funding: \$532 278
 - Duration: 2/15/2022 – 2/14/2027
- 2020 NSF CPS Medium grant on “*Correct-by-Construction Controller Synthesis using Gaussian Process Transfer Learning*”
- Role: Lead PI, joint with Eric Frew and Morteza Lahijanian
 - Total funding: \$1 200 000 (**My Share:** \$413 746)
 - Duration: 1/01/2021 – 12/31/2023
- 2020 NSF grant on “*Secure-by-Construction Controller Synthesis for Cyber-Physical Systems*”
- Role: Lead PI, joint with Ashutosh Trivedi
 - Total funding: \$387 640 (**My Share:** \$193 820)
 - Duration: 8/15/2020 – 7/31/2023
- 2020 NSF grant on “*An Entropy Approach to Invariance and Reachability of Uncertain Control Systems with Limited Information*”
- Role: Sole PI
 - Total funding: \$379 327
 - Duration: 6/1/2020 – 5/31/2023
- 2019 ASIRT seed grant on “*Towards scalable synthesis of large-scale cyber-physical systems*”
- Role: Lead PI, joint with Morteza Lahijanian, Sriram Sankaranarayanan, Fabio Somenzi, and Ashutosh Trivedi
 - Total funding: \$46 800 (**My Share:** \$38 776)

LUDWIG MAXIMILIAN AND TECHNICAL UNIVERSITY OF MUNICH

ACQUIRED:

- 2023 ERC Proof of Concept grant on “*Automated Synthesis of Certifiable Control Software for Autonomous Vehicles*”
- Role: Sole PI
 - Total funding: €150 000
 - Duration: 2/1/2023 – 7/30/2024
- 2023 DFG Research Training Group on “*Continuous Verification of Cyber-Physical Systems*”
- Role: PI, joint with Susanne Albers (TU Munich, PI), Matthias Althoff (TU Munich, PI), Dirk Beyer (LMU Munich, PI), Jasmin Blanchette (LMU Munich, PI), Javier Esparza (TU Munich, PI), Debarghya Ghoshdastidar (TU Munich, PI), Marie-Christine Jakobs (LMU Munich, PI), Johannes Kinder (LMU Munich, PI), Jan Kretinsky (TU Munich, PI), and Angela Schoellig (TU Munich, PI)
 - Total funding: €5 733 090 (My Share: €531 460)
 - Duration: 6/1/2024 – 12/31/2027
- 2020 DFG grant on “*Opacity of Large-Scale Cyber-Physical Systems*”
- Role: Sole PI
 - Total funding: €421 917
 - Duration: 12/10/2020 – 12/9/2023
- 2020 DFG continuation grant on “*Automated Synthesis of Networked Control Systems*”
- Role: Sole PI
 - Total funding: €108 505
 - Duration: 11/17/2020 – 11/17/2021
- 2020 Bavarian support for initiation of international research collaborations with University of Waterloo for the project on “*Towards memory efficient construction of symbolic controllers: Parallelism + dynamic abstractions*”, funding: €5 227
- 2019 Bavaria California Technology Center (BaCaTeC) funding for continuing the collaboration with University of California, Berkeley, on the project entitled “*Certifiable Synthesis of Autonomous Systems*”, funding: €15 000
- 2018 DFG Research Training Group on “*Continuous Verification of Cyber-Physical Systems*”

- Role: PI, joint with Susanne Albers (TU Munich, PI), Matthias Althoff (TU Munich, PI), Dirk Beyer (LMU Munich, PI), Javier Esparza (TU Munich, PI), Jan Kretinsky (TU Munich, PI), Tobias Nipkow (TU Munich, PI), and Helmut Seidl (TU Munich, PI)
 - Total funding: €5 989 666 (My Share: €580 500)
 - Duration: 6/1/2019 – 12/31/2023
- 2018 DFG project on “*Compositional Synthesis of Abstractions for Infinite Networks*”
- Role: PI, joint with Navid Noroozi (LMU Munich, PI)
 - Total funding: €590 036 (My Share: €284 668)
 - Duration: 4/1/2019 – 9/30/2021
- 2018 ERC Starting Grant on “*Automated Synthesis of Cyber-Physical Systems: A Compositional Approach*”
- Role: Sole PI
 - Total funding: €1 500 000
 - Duration: 2/1/2019 – 1/30/2024
- 2018 DFG project on “*Information Measures for Control: Invariance and Reachability*”
- Role: Sole PI
 - Total funding: €298 800
 - Duration: 8/1/2018 – 7/30/2021
- 2018 Bavarian support for initiation of international research collaborations with Tokyo Institute of Technology for the project on “*Approximate abstractions for networks of control systems: A model order reduction*”, funding: €8 812
- 2017 TUM Global Incentive Fund for collaborating with Georgia Institute of Technology and Shanghai Jiao Tong University, funding: €14 625
- 2017 Study grant for founding a lab on “*FPGA implementations and hardware-in-the-loop simulations of correct-by-construction embedded controllers*”, funding: €40 820
- 2017 Bavarian support for initiation of international research collaborations with TU Delft for the project on “*Formal synthesis of stochastic control systems: A probability approach*”, funding: €5 703
- 2016 TUM Global Incentive Fund for collaborating with University of California, Los Angeles, funding: €14 935

- 2016 Bavarian-French inter-university cooperation (BFHZ) funding for collaborating with Laboratoire des Signaux et Systèmes (L2S) - CNRS, funding: €4 200
- 2016 Munich Aerospace project on “*Certifiable Autonomy in Unmanned Aerial Vehicles*”,
- Role: PI, joint with Gunther Reissig (Bundeswehr University Munich, PI)
 - Total funding: €140000 (My Share: €70 000)
 - Duration: 10/1/2016 – 11/30/2019
- 2015 Bavaria California Technology Center (BaCaTeC) funding for initiating a collaboration with University of California, Berkeley, on the project entitled “*Automated Synthesis of Cyber-Physical Systems: A Passivity-Based Approach*”, funding: €4 000
- 2015 IGSSE project on “*Platform-Aware Synthesis of Embedded Control Software*”
- Role: Lead-PI, joint with Samarjit Chakraborty (TU Munich, PI), Javier Esparza (TU Munich, PI), Jan Kretinsky (TU Munich, PI)
 - Total funding: €517 050 (My Share: €172 350)
 - Duration: 10/1/2016 – 11/30/2019
- 2015 DFG project on “*Automated Synthesis of Networked Control Systems*”
- Role: Sole PI
 - Total funding: €284 300
 - Duration: 9/1/2015 – 6/30/2019
- 2015 Special Program “*Steigende Studierendenzahlen*” for the project “eCARus 0.2 - Efficiency Through Networking”, funding: €6 000
- 2015 Bavarian support for initiation of international research collaborations with Boston University for the project on “*Automated Synthesis of Interconnected Cyber-Physical Systems*”, funding: €8 601
- 2014 Study grant for founding a lab on “*Automated Verification and Synthesis*”, funding: €41 250

Professional Services

PHD THESIS COMMITTEE

- Oct'23 “*Machine Learning and Data-Driven Techniques for Verification and Synthesis of Cyber-Physical Systems*” by Ali Salamati
- Sep'23 “*Formal Analysis of Control Systems via Inductive Approaches: Tackling Scalability, Conservatism, and Complex Specifications*” by Mahathi Anand

Sep'23	<i>"Formal Synthesis of Partially-Observable Cyber-Physical Systems"</i> by Niloofar Jahanshahi
Jul'23	<i>"Formal Methods for Sandboxing Controllers in Cyber-Physical Systems"</i> by Bingzhuo Zhong
Jun'23	<i>"Formal Verification and Control of Stochastic Hybrid Systems: Model-based and Data-driven Techniques"</i> by Ameneh Nejati
Sep'22	<i>"Secure-by-Construction Synthesis of Cyber-Physical Systems"</i> by Siyuan Liu
Sep'21	<i>"Efficient implementation of symbolic controllers for cyber-physical systems"</i> by Mahmoud Khaled
Sep'21	<i>"Invariance feedback entropy of uncertain nonlinear control systems"</i> by Mahendra Singh Tomar
Dec'20	<i>"Formal Synthesis of Controllers for Complex Dynamical Systems: State-Space Discretization-free Approaches"</i> by Pushpak Jagtap
Dec'20	<i>"Compositional Synthesis of Symbolic Models for (In)Finite Networks of Cyber-Physical Systems"</i> by Abdalla Swikir
Dec'19	<i>"Automated Verification and Control of Large-Scale Stochastic Cyber-Physical Systems: Compositional Techniques"</i> by Abolfazl Lavaei
Jun'19	<i>"Bisimilar Stochastic Systems"</i> by Ilya Tkachev
Jul'18	<i>"Constrained nonlinear Control for Safe Human-Robot interaction"</i> by Melanie Kimmel
Apr'18	<i>"Adaptive identification and control of uncertain systems with switching"</i> by Stefan Kersting
Jan'18	<i>"Optoacoustic endoscopy: system development and application"</i> by Hailong He
Dec'17	<i>"Control and stability of power systems using reachability analysis"</i> by Ahmed El-Guindy
Mar'17	<i>"Elastically actuated bipedal robots"</i> by Gianluca Garofalo
Mar'15	<i>"A selective packet discard technique for efficient deadlock recovery in networks-on-chip"</i> by Andreas Lankes

REVIEWING ACTIVITIES

Journals	IEEE Transaction on Automatic Control ◦ IEEE Transactions on Control of Network Systems ◦ Automatica ◦ Systems and Control Letters ◦ Nonlinear Analysis: Hybrid Systems ◦ SIAM Journal on Control and Optimization ◦ SIAM Journal on Applied Dynamical Systems ◦ International Journal of Robust and Nonlinear Control ◦ IEEE Transactions on Evolutionary Computation ◦ Theoretical Computer Science
Conferences	IEEE Conference on Decision and Control ◦ American Control Conference ◦ European Control Conference ◦ International Conference on Hybrid Systems: Computations and Control ◦ International Conference on Cyber-Physical Systems ◦ Computer Aided Verification ◦ Analysis and Design of Hybrid Systems ◦ Multiconference on Systems and Control ◦ International Symposium on Mathematical Theory of Networks and Systems ◦ Mediterranean Conference in Control and Automation

PROGRAM COMMITTEE & EDITORIAL

2023	Associate editor of IEEE Transactions on Automatic Control
2023	27th International Conference on Hybrid Systems: Computations and Control (HSCC)
2022	26th International Conference on Hybrid Systems: Computations and Control (HSCC)
2021	25th International Conference on Hybrid Systems: Computations and Control (HSCC)

2021 Associate editor of European Control Conference (ECC)
 2021 IFAC Conference on Analysis and Design of Hybrid Systems (ADHS)
 2020 24th International Conference on Hybrid Systems: Computations and Control (HSCC)
 2019 23rd International Conference on Hybrid Systems: Computations and Control (HSCC)
 2019–now Associate editor of Nonlinear Analysis: Hybrid Systems
 2019–now Associate editor of Discrete Event Dynamic Systems
 2019 12th International Workshop on Numerical Software Verification (**Program chair**)
 2018 22nd International Conference on Hybrid Systems: Computations and Control (HSCC)
 2018 5th Indian Control Conference (ICC)
 2018 IFAC Conference on Analysis and Design of Hybrid Systems (ADHS)
 2018 4th Indian Control Conference (ICC)
 2017 2nd International Workshop on Verification and Validation of Cyber-Physical Systems
 2017 15th International Conference on Formal Modelling and Analysis of Timed Systems
 2017 3rd Indian Control Conference (ICC)
 2016 19th International Conference on Hybrid Systems: Computations and Control (HSCC)
 2015 18th International Conference on Hybrid Systems: Computations and Control (HSCC)
 2014 1st International Workshop on Smart Embedded Systems

ORGANIZER/CO-ORGANIZER

May'23 Workshop on “Computation-Aware Algorithmic Design for Cyber-Physical Systems” at the Cyber-Physical Systems and Internet-of-Things Week.
 May'22 Workshop on “Computation-Aware Algorithmic Design for Cyber-Physical Systems” at the Cyber-Physical Systems and Internet-of-Things Week.
 May'21 Workshop on “Computation-Aware Algorithmic Design for Cyber-Physical Systems” at the Cyber-Physical Systems and Internet-of-Things Week.
 Dec'18 Workshop on “Computation-aware Algorithmic Design for Cyber-Physical Systems” at the 57th IEEE Conference on Decision and Control (CDC), Miami Beach, FL, USA.
 May'17 Dagstuhl Seminar on “Formal Synthesis of Cyber-Physical Systems”, Wadern, Germany.
 Jan'16 Tutorial on “Trustworthy Cyber-Physical Systems” at the 29th International Conference on VLSI Design and 15th International Conference on Embedded Systems, Kolkata, India.
 Dec'15 Workshop on “Towards Scalable Formal Synthesis of Complex Systems” at the 54th IEEE Conference on Decision and Control (CDC), Osaka, Japan.
 Jul'15 Invited session on “Formal Methods in Control” in American Control Conference (ACC), Chicago, USA.
 Dec'14 Two invited sessions on “Formal Methods in Control” in the 53rd IEEE Conference on Decision and Control (CDC), Los Angeles, USA.
 Oct'14 Tutorial on “Modeling, Validation and Synthesis of Embedded Control Software” at Embedded Systems Week (ESWEEK), New Delhi, India.
 Aug'14 Tutorial on “Automotive Cyber-Physical Systems” at the 20th IEEE Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA), Chongqing, China.
 Jul'14 A mini-course on “Automated verification and synthesis of complex systems” at the 21st Symposium on Mathematical Theory of Networks and Systems (MTNS), Groningen, The Netherlands.
 Jun'14 Invited session on “Formal Methods in Control” in American Control Conference (ACC),

Portland, USA.

Dec'13 Two invited sessions on "Formal Methods in Control" in the 52nd IEEE Conference on Decision and Control (CDC), Florence, Italy.

CHAIR/CO-CHAIR

2024 General chair of the 8th IFAC Conference on Analysis and Design of Hybrid Systems
2020–now Chair of the IEEE Technical Committee on Hybrid Systems
2013–now IEEE Conference on Decision and Control ◦ American Control Conference ◦ International Conference on Hybrid Systems: Computations and Control ◦ International Symposium on Mathematical Theory of Networks and Systems

PROFESSIONAL MEMBERSHIP

2008–now Institute for Electrical and Electronics Engineers (IEEE): Control Systems Society ◦ International Federation of Automatic Control (IFAC) ◦ Society for Industrial and Applied Mathematics (SIAM) ◦ Association for Computing Machinery (ACM)

Talks, Seminars, & Presentations

INVITED SEMINARS

Dec'23 Department of Electrical and Information Engineering, Osaka City University
Jun'21 Department of Mechanical Engineering, University of California San Diego
Mar'21 Department of Computing Science, University of Oldenburg, Germany
Jun'19 Delft Center for Systems and Control, Delft University of Technology, The Netherlands
May'19 Institute for Advanced Study, Technical University of Munich, Germany
Aug'18 Department of Automation, Shanghai Jiao Tong University, Shanghai, China
May'18 Department of Systems and Control Engineering, Tokyo Institute of Technology, Japan
Oct'17 School of Electrical and Computer Engineering, Georgia Institute of Technology, USA
Jun'17 Chair of Dynamical Systems, University of Passau, Germany
May'17 Institute of Robotics and Mechatronics, German Aerospace Center, Germany
Jan'17 Institute for Systems Theory and Automatic Control, University of Stuttgart, Germany
Aug'16 Electrical and Computer Engineering, University of Toronto, Toronto, Canada
May'16 Electrical Engineering and Computer Science Department, University of California, Berkeley, USA
May'16 Department of Electrical, Computer, and Energy Engineering, University of Colorado, Boulder, USA
Sep'15 Mechanical and Aerospace Engineering Department, University of California, Irvine, USA
Sep'15 Electrical Engineering Department, University of Southern California, Los Angeles, USA
Sep'15 Mechanical Engineering Department, Massachusetts Institute of Technology, Boston, USA
Sep'15 CISE Seminar, Division of Systems Engineering, Boston University, Boston, USA
Nov'14 Acentiss GmbH, Germany
Aug'14 Fortiss GmbH, Germany
Jul'14 Ludwig Maximilians Universität München, Munich, Germany
Jun'14 Max-Planck Institute for Biological Cybernetics, Tübingen, Germany

Oct'13 Industrial Design Engineering Department, Technical University of Delft, The Netherlands
 Jul'13 Johann Bernoulli Institute for Mathematics and Computer Science, University of Groningen, The Netherlands
 Jun'13 Automatic Control Laboratory, Swiss Federal Institute of Technology (ETH) Zürich, Switzerland
 Jun'13 Electrical and Computer Engineering Department, Technical University of Munich, Germany
 May'13 Max-Planck Institute for Software Systems, Kaiserslautern, Germany
 May'13 ACCESS Linnaeus Center, School of Electrical Engineering, Royal Institute of Technology (KTH), Sweden
 Jan'13 Mechanical Engineering Department, Technical University of Eindhoven, The Netherlands
 May'11 Robert Bosch LLC, USA
 Apr'11 Control and Dynamical Systems, California Institute of Technology (Caltech), USA

INVITED TUTORIALS, WORKSHOPS, & COLLOQUIUMS

Dec'23 Workshop on “Formal Methods in System Resilience: From Analysis to Control”, Singapore
 Jul'23 Keynote speaker at Workshop on Hyperproperties: Advances in Theory and Practice
 Jan'23 IEEE CSS Workshop on Control Software Synthesis for CPS
 Aug'19 The 3rd International Workshop on Methods and Tools for Distributed Hybrid Systems, Amsterdam, The Netherlands
 Apr'19 The 5th International Workshop on Symbolic-Numeric methods for Reasoning about CPS and IoT (SNR), Montreal, Canada
 Sep'18 Industry 4.0 panel at Forum on specification & Design Languages (FDL) 2018, Munich
 Jan'16 Tutorial on “Trustworthy Cyber-Physical Systems” at the 29th International Conference on VLSI Design and 15th International Conference on Embedded Systems, Kolkata, India
 Dec'15 Workshop on “Towards Scalable Formal Synthesis of Complex Systems” at the 54th IEEE Conference on Decision and Control (CDC), Osaka, Japan
 Nov'15 2nd Munich Aerospace Colloquium on Autonomous Flight, Munich, Germany
 Oct'14 Tutorial on “Modeling, Validation and Synthesis of Embedded Control Software” at Embedded Systems Week (ESWEEK), New Delhi, India
 Aug'14 Tutorial on “Automotive Cyber-Physical Systems” at the 20th IEEE Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA), Chongqing, China
 Jul'14 Mini-course on “Automated verification and synthesis of complex systems” at the 21st Symposium on Mathematical Theory of Networks and Systems (MTNS), Groningen, The Netherlands
 May'11 Southern California Nonlinear Control Workshop, Riverside, USA
 May'10 Workshop on “Formal Methods for Robotics and Automation” at IEEE Conference on Robotics and Automation (ICRA), Anchorage, USA
 Oct'09 Southern California Nonlinear Control Workshop, Irvine, USA

CONFERENCE PRESENTATIONS

Dec'23 IEEE Conference on Decision and Control, Singapore
 Jun'23 American Control Conference, San Diego, CA, USA

Jun'22 American Control Conference, Atlanta, GA, USA
 Jul'19 12th International Workshop on Numerical Software Verification, New York, USA
 Jun'18 American Control Conference, Milwaukee, WI, USA
 Apr'18 International Conference on Hybrid Systems: Computations and Control, Porto, Portugal
 Sep'16 Annual Allerton Conference on Communication, Control, and Computing, Monticello, USA
 Aug'16 International Conference on Formal Modelling and Analysis of Timed Systems, Quebec City, Toronto
 Dec'15 IEEE Conference on Decision and Control, Osaka, Japan
 Jul'15 American Control Conference, Chicago, USA
 Dec'14 IEEE Conference on Decision and Control, Los Angeles, USA
 Jun'14 American Control Conference, Portland, USA
 Apr'14 International Conference on Hybrid Systems: Computations and Control, Berlin, Germany
 Dec'13 IEEE Conference on Decision and Control, Florence, Italy
 Jul'13 European Control Conference, Zürich, Switzerland
 Jul'12 International Conference on Computer Aided Verification, Berkeley, USA
 Dec'11 IEEE Conference on Decision and Control, Orlando, USA
 Dec'10 IEEE Conference on Decision and Control, Atlanta, USA
 Jun'10 American Control Conference, Baltimore, USA

FORMAL INTERNAL SEMINARS

Sep'16 Cluster-initiative on “Cyber-Physical Product(ion) Systems”
 Nov'15 IAS Focus Group Kick-off on “Automated Controller Synthesis”
 Jun'14 Center of Competence Embedded and Cyber-physical Systems
 May'14 Introductory Seminar, Technical University of Munich
 Nov'12 Delft Center for Systems and Control, Technical University of Delft
 Jul'12 Electrical Engineering Department, University of California, Los Angeles
 Nov'10 Electrical Engineering Department, University of California, Los Angeles
 Nov'07 Electrical Engineering Department, Sharif University of Technology
 Jun'05 Electrical Engineering Department, Isfahan University of Technology

Publications

Total Citations: 4657 (Google Scholar)

h-index: 33 (Google Scholar)

i10-index: 104 (Google Scholar)

PREPRINTS

- [1] M. Anand, G. J. Pappas, and M. Zamani. “Distributed Safety Controller Synthesis for Unknown Interconnected Systems via Graph Neural Networks”. In: *IEEE Control Systems Letters*, under review (2023).
- [2] N. Jahanshahi, B. Zhong, and M. Zamani. “Sandboxing (AI-based) Unverified Controllers in Partially-Observable Systems: A Data-Driven Approach”. In: *IEEE Transactions on Automatic Control*, under review (2023).
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Research Software (Open Source)

1. SCOTS:

- An open source software tool for the synthesis of symbolic controllers for possibly perturbed, nonlinear, control systems. It is mainly implemented in C++ and it comes with a small MATLAB interface to access the synthesized controller from within MATLAB. SCOTS *has been one of the main tools in the hybrid systems community for the correct-by-construction design of controllers and has been benchmarked against by many recently developed tools in this direction*. It has been cited over 140 times and downloaded over 1k times. <https://gitlab.lrz.de/hcs/scots>

2. SENSE:

- An open source software tool for the symbolic abstraction and controller synthesis of networked control systems (NCS). It is implemented in C++ and comes with MATLAB and OMNet++ interfaces to access the synthesized controller as well as to simulate the closed-loop NCS. One can consider four types of network non-idealities in SENSE: (i) quantization errors; (ii) limited bandwidth; (iii) time varying communication delays; and (iv) packet dropouts as long as the maximum number of consecutive dropouts over the network is bounded. SENSE has many helper tools to facilitate the analysis of the resulting symbolic models and controllers. For example, one of them allows for the automatic code generation of the resulting symbolic controllers. <https://gitlab.lrz.de/hcs/sense>

3. QUEST:
 - An open source software tool for automated controller synthesis of incrementally input-to-state stable nonlinear control systems. The tool uses state-space quantization-free approach for the construction of symbolic abstractions which can be potentially more beneficial for systems with high-dimensional state spaces. The tool uses fixed length of quantized input sequences as symbolic states of the abstraction which helps to alleviate the curse of dimensionality. <https://gitlab.lrz.de/hcs/QUEST>
4. pFaces:
 - A generic cloud-ready, multi-compute-platform, tool for accelerating parallel algorithms. pFaces is an acceleration engine that works with kernels representing different software sections. Users have the freedom to parallelize parts of their software via loadable execute kernels. Kernels in pFaces are developed in C++ with OpenCL. pFaces offers a friendly SDK to build the kernels remotely (as dynamically loadable plugins) and then run them in several HW configurations. pFaces then takes the effort of running the kernels efficiently on the targeted HW. For example, tools AMYTISS, PIRK, and OmegaThreads (explained next) are all built as kernels for pFaces. <https://github.com/parallall/pFaces>
5. AMYTISS:
 - An advanced software tool developed in C++/OpenCL that provides parallel automated controller synthesis for discrete-time stochastic control systems which is absolutely crucial in many safety-critical applications such as autonomous driving. This tool allows to: 1) build finite Markov decision processes (MDPs) as finite abstractions of given original stochastic systems; 2) synthesize controllers for the constructed finite MDPs satisfying some high-level specifications (safety, reachability & reach-avoid). <https://github.com/mkhaled87/pFaces-AMYTISS>
6. PIRK:
 - A tool to efficiently compute reachable sets for general nonlinear systems of extremely high dimensions. PIRK can utilize HPC platforms for computing reachable sets for general high-dimensional non-linear systems. PIRK has been tested on several systems, with state dimensions up to **4 billion**. The scalability of PIRK's parallel implementations is found to be highly favorable. In PIRK, three parallelized interval reachability analysis methods are introduced. PIRK uses simulation-based reachability methods which compute rigorous approximations to reachable sets by integrating one or more systems of ODEs. PIRK is developed in C and OpenCL. PIRK can be run on a wide range of computing platforms, including CPUs clusters, GPUs, and hardware accelerators from any vendor, as well as cloud-based services like Amazon AWS. <https://github.com/mkhaled87/pFaces-PIRK>
7. OmegaThreads:
 - A tool for parallel automated controller synthesis of dynamical systems to satisfy ω -regular specifications, for example those given as LTL formulae or

nondeterministic Büchi automata. `OmegaThreads` constructs a deterministic ω -automaton with a parity acceptance condition representing the input LTL specifications. The given model (e.g., a set of differential equations) of the dynamical system is used to construct a symbolic system that abstracts the model. `OmegaThreads` then builds a parity game (the model is one player and the controller is another player) using the symbolic model and the specification's automaton. Finally, `OmegaThreads` solve the game playing at the controller side using the strategy iteration solver from tool `Strix`. Winning the game results in a closed-loop controller that is guaranteed to enforce the given specification on the dynamical system. `OmegaThreads` generates the synthesized controller as a Mealy machine. <https://github.com/mkhaled87/pFaces-OmegaThreads>