CURRICULIM VITAE[1]

PERSONAL INFORMATION
Zamira Daw
Professor of Aircraft Systems
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PROFESSIONAL CAREER

Professor of Aircraft Systems, University of Stuttgart, Stuttgart, Germany, 2023 -Present

Senior Manager, Team Lead of AI Systems Engineering, Berkeley, California, USA, 2020 – 2023
Raytheon Technologies Research Center

Staff Engineer/Scientist - Model-based design, Berkeley, California, USA, 2017 – 2020
United Technologies Research Center

Senior Engineer/Scientist - Model-based design, Berkeley, California, USA, 2015 – 2017
United Technologies Research Center

Postdoctoral Researcher, University of Maryland, College Park, Maryland, USA, 2013 –2015
Institute for Systems Research and Department of Computer Science

Visiting Researcher, University of Maryland, College Park, Maryland, USA, 2012 July - September
Institute for Systems Research and Department of Computer Science

Research Assistant, Hochschule Mannheim – University of Applied Science, Mannheim, 2008 – 2013
EMB-Lab: Institute for Embedded Systems and Medical Technology.

Research Assistant, Hochschule Mannheim – University of Applied Science, Mannheim, 2007 – 2008
Heidelberg University, MABEL: Institute Mannheim Biomedical Engineering Laboratories

EDUCATION

Dr. -Ing., Electrical Engineering and Computer Science

2013 University of Kassel, Kassel
Thesis: Model-Driven Development Methodology for Hybrid Embedded Systems Based on UML with Emphasis on Safety-Related Requirements

Master of Science in Information Technology

2008 Hochschule Mannheim – University of Applied Science, Kassel
Thesis: Analysis and Development of a Method for Determination of Elastic Properties of Arterial Blood Vessel Based on Pulse Transit Time Measurement

Bachelors in Electronics Engineering

2004 Pontificia Universidad Javeriana, Bogotá, Colombia
Thesis: Control of Immersion for a Robotic Underwater Platform

RESEARCH PROJECTS & GRANTS

2019 **Automatic Assurance Case Engine (AACE)**
Development of synthesis and verification algorithms for automatic generation, validation and uncertainty

[1] Updated 27.02.2023

quantification of human-understandable assurance cases for certification.

2019 **Understanding Overarching Properties for Industrial Application (UTOPIA)**

Development of a methodology and practical guidance for using Overarching Properties to propose novel means of compliance for aerospace systems.

2018 **Hybrid Efficient Reasoning Method for Explainable and Scalable formal methods (HERMES)**

Development of a verification framework that decomposes the verification of complex system in smaller verification tasks so that different formal methods tools can be used.

2018 **Modeling and Verification of Human-Machine Systems (MoveHMS)**

Development of a new class of models and tools for requirement engineering and refinement of autonomous systems; addressing the inadequacies of current methods for high-assurance systems when applied to intelligent systems.

2016 **Autonomous Cargo Handling System (ACHS)**

Development of a system that can be installed in any aircraft to automate tasks and reduce aircrew workload. Leading the development of technologies for knowledge modeling and verification.

2013 **Computational Modeling and Analysis for Complex Systems (CMACS)**

Gain fundamental new insights into the emergent behavior of complex biological and embedded systems through the use of revolutionary, highly scalable and fully automated modeling and analysis techniques.

2008 **MERSES (Model-driven development and implementation patterns for signal-processing embedded systems)**

Development data-flow modeling techniques to facilitate the design of embedded systems for systems with signal processing tasks.

AWARDS

2005 INTERSTIP Scholarship for International Students with Outstanding Performance, Hochschule Mannheim – University of Applied Science

2004 Excellent academic performance, Schlumberger

SERVICE / REVIEWER

2022 Organizer of Workshop on Design Automation for the Certification of Autonomous Systems (DAC-AS)
2019 Member of Overarching Properties Working Group
2016 Review for Journal of Formal Methods in System Design
2016 Review for Journal of Logical and Algebraic Methods in Programming
2016 Review for IEEE Transactions on Computers
2016 Review for Transactions on Cyber-Physical Systems
2016 Review for International Journal of Computers Science and Information Technology
2016 Review for International Joint Conference on Artificial Intelligence
2016 Review for Conference on Advanced Information Technologies and Applications
2014 Review for International Journal of Computer Assisted Radiology and Surgery

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LANGUAGES

Spanish	Native speaker
English	Proficient
German	Proficient
Portuguese	Basic

TEACHING, MENTORING AND ADVISING

EDUCATION ON TEACHING

2021	Course on Teaching Science at University, University of Zurich.

EXPIRIENCE IN TEACHING

2002	Teaching Assistant, Differential Calculus, Javeriana University
2002	Teaching Assistant, Integral Calculus, Javeriana University
2002	Teaching Assistant, Systems and Circuits, Javeriana University

EXPIRIENCE IN MENTORING

2020	Nickil, Graduate Intern, United Technologies Research Center
2015	John Mangino, High School Intern, University of Maryland
2011	Oscar Pinilla, Masterstudent, Hochschule Mannheim
2012	Leonardo Valdivieso, Masterstudent, Hochschule Mannheim
2010	Christian Englert, Bachelorstudent, Hochschule Mannheim
2010	Rüdiger Willenberg, Masterstudent, Hochschule Mannheim
2010	Tobias Geis, Bachelorstudent, Hochschule Mannheim
2010	Flor Alvarez, Masterstudent, Hochschule Mannheim

LIST OF PUBLICATIONS

JOURNAL PUBLICATIONS

1. **Zamira Daw**, and Rance Cleaveland, Comparing model checkers for timed UML-Activity diagrams, in Proceedings of Science of Computer Programming – (2015).
2. **Zamira Daw**, Rance Cleaveland and Marcus Vetter. Formal verification of software-based medical devices considering medical guidelines, in International Journal of Computer Assisted Radiology and Surgery (IJCARS). 2013.
3. Xuan P Nguyen, Ralf Kronemayer, Peter Herrmann, Atila Mejía, **Zamira Daw**, and Xuan D Nguyen, Bettina Kränzlin and Norbert Gretz, Validation of a new non-invasive blood pressure measurement method on mice via pulse wave propagation time measurement on a cuff. In Journal of Biomedical Engineering/ Biomedizinische Technik, Volume 56, Year 2011, Number 3, Pages 153-158.

REFEREED PUBLICATIONS

4. Timothy Wang, Alessandro Pinto, **Zamira Daw** “Hierarchical Contract-based Synthesis for Assurance Cases”, planned to be submitted to NASA Formal Methods 2022.
5. Oh, Chanwook, Nikhil Naik, **Zamira Daw**, Timothy E. Wang, and Pierluigi Nuzzo. "ARACHNE: Automated Validation of Assurance Cases with Stochastic Contract Networks." In Computer Safety, Reliability, and Security: 41st International Conference, SAFECOMP 2022, Munich, Germany, September 6–9, 2022, Proceedings, pp. 65-81. Cham: Springer International Publishing, 2022.

6. **Zamira Daw**, Scott Beecher, Michael Holloway, and Mallory Graydon, "Overarching Properties as Means of Compliance: An Industrial Case Study." IEEE/AIAA 36th Digital Avionics Systems Conference (DASC), IEEE, 2021.
7. **Zamira Daw,** Scott Beecher, Michael Holloway, and Mallory Graydon, "Understanding Overarching Properties for Industrial Application" International Aviation Software Summit, 2021, RTCA.
8. **Zamira Daw**, Emeka Eyisi, Ebad Jahangir, and Jeanne Larsen. "Formal modeling of certification processes." In 2017 IEEE/AIAA 36th Digital Avionics Systems Conference (DASC), pp. 1-8. IEEE, 2017.
9. **Zamira Daw,** John Mangino, and Rance Cleaveland, UML-VT: Model checking for timed UML activities, in Tools/Demonstrations of International Conference on Model Driven Engineering Languages and Systems, 2015.
10. **Zamira Daw,** and Rance Cleaveland, An extensible operational semantics for UML activity diagrams, in International Conference on Software Engineering and Formal Methods. 2015.
11. **Zamira Daw,** Rance Cleaveland and Marcus Vetter, Integrating of model checking and UML based model-driven development for embedded systems, in Proceedings of 13th International Workshop on Automated Verification of Critical Systems (AVOCS). 2013
12. **Zamira Daw,** Rance Cleaveland and Marcus Vetter. Formal verification of software-based medical devices considering medical guidelines, in Proceedings of Computer Assisted Radiology and Surgery 27th International Congress and Exhibition (CARS). 2013.
13. **Zamira Daw,** Josef Börcsök and Marcus Vetter. Towards safety analysis of model-based embedded software, in Proceedings of Safety Systems for Real-Time Applications in Accordance to International Standards. 2012.
14. **Zamira Daw,** Josef Börcsök and Marcus Vetter. Towards safe data flow processing by integration of Design by Contract in deterministic UML activities, in Proceedings of the XXIV International Symposium on Information, Communication and Automation Technologies, ICAT 2011.
15. **Zamira Daw,** Christian Englert, Flor Alvarez, Josef Börcsök and Marcus Vetter. Model-driven timing analysis and verification for safety-critical embedded systems, in Proceedings of the Safety Integrated Systems and Applications for Condition Monitoring and Diagnosis, 2011.
16. Ruediger Willenberg, **Zamira Daw** and Marcus Vetter. Generation of deterministic MCU/FPGA hybrid systems from UML activities, 20th International Conference on Field Programmable Logic and Applications, Milano, Italy, 2010
17. **Zamira Daw,** Flor Alvarez, Christian Englert, Rüdiger Willenberg and Marcus Vetter. Deterministische Embedded Systeme aus UML-Modellen, Embedded Software Engineering Kongress, Sindelfingen, 2009, pp. 517- 523.
18. **Zamira Daw** and Marcus Vetter. Methode zur Entwicklung sicherheitskritischer eingebetteter Systeme mittels deterministischer UML-Modelle, Workshop Entwicklung zuverlässiger Software-Systeme, Regensburg, 2009, Softwaretechnik-Trends Band 29 Heft 3, pp.11-16.
19. **Zamira Daw** and Marcus Vetter. Deterministic UML Models for Interconnected Activities and State Machines. In: A. Schürr and B. Selic : ACM/IEEE 12th International Conference on Model Driven Engineering Languages and Systems. LNCS, vol. 5795, pp. 556–570. 2009. Springer

NON-REFERRED PAPERS

20. **Zamira Daw,** and Rance Cleaveland, An extensible formal semantics for UML activity diagrams, Technical Report, http://arxiv.org/abs/1604.02386 2016.
21. **Zamira Daw,** Rüdiger Willenberg, Tobias Geis, Marcus Vetter and Josef Börcsök. DMOSES: Model-driven development for deterministic embedded systems, NEMA 2010 Next Generation Tools and Platforms for embedded media applications, 2010 Feb 23-24, Darmstadt, Germany

BOOK

22. **Zamira Daw,** Model-driven development methodology for hybrid embedded systems based on UML with emphasis on safety-related requirements. Kassel university press GmbH, 2014.

PATENTS

1. U.S. Patent US10994865B2, "Autonomous system for air cargo end-to-end operations", granted May 04, 2021. Inventors: **Zamira A. Daw Perez,** Alessandro Pinto, Richa Varma, Binu M. Nair, and Xiaobin Zhang.
2. U.S. Patent US10782179B2, "On-board unit load device weight estimation", granted September 22, 2020. Inventors: **Zamira A. Daw Perez**, Alessandro Pinto, Richa Varma, Binu M. Nair, Xiaobin Zhang, Aaron J Roberts, and Scott Harms.
3. U.S. Patent US10005564B1, "Autonomous cargo handling system and method", granted June 6, 2018. Inventors: Amit Bhatia, **Zamira Daw Perez**, Alessandro Pinto, and Julian C. Ryde.
4. U.S. Patent US20200122834A1, "Multi-robots system for cargo handling", pending. Inventors: **Zamira A. Daw Perez,** Alessandro Pinto, Richa Varma, Binu M. Nair, and Xiaobin Zhang.
5. U.S. Patent US10994865B2, "Self-calibrating multi-sensor cargo handling system and method", pending. Inventors: **Zamira A. Daw Perez,** Alessandro Pinto, Richa Varma, Binu M. Nair, and Xiaobin Zhang.

INVITED TALKS and PANELS

2021 International Council on Systems Engineering (INCOSE) Workshop Keynote, "Overarching Properties as a Next Generation Safety Assurance Standard" (in December)

2021 NASA Langley, "Understanding Overarching Properties for Industrial Applications".

2021 Overarching Properties Working Group (FAA/NASA), "Certification Argument for an on-board model of an UAV"

2021 41st IEEE Real-Time System Symposium, Industry Panel "Challenges and Directions for Verification in Aerospace"

2020 Overarching Properties Working Group (FAA/NASA), "Understanding Overarching Properties for Industrial Application"

2017 University of Maryland, "Formal modeling of certification processes"

2015 ES Seminars, University of York, "Model-driven development for safety-related embedded systems", Pontificia Universidad Javeriana

2015 Hochschule Mannheim University of Applied Science, "Integration formalen Methoden in die modellgetriebene Entwicklung"

2014 Girls Excelling in Math and Science, University of Maryland

2014 Grad Women Research Seminar Series, University of Maryland

2013 Computational Modeling and Analysis for Complex Systems (CMACS) Workshop, "Integrating model checking and UML based model-driven development for embedded systems"

SELECTED PUBLICATIONS

1. **Zamira Daw, and Rance Cleaveland, "Comparing model checkers for timed UML-Activity diagrams", in Proceedings of Science of Computer Programming –111 (2015): 277-299.**

   Checking properties of systems early in the development process has a huge impact on the cost and schedule of a product. Although in theory model checking could verify these system properties, there are still two bottle necks in practice: scalability for real systems, and the limited usability by common engineers. Therefore, we integrated model checking into UML-based system development processes by formally defining UML semantics and creating translators to model checkers. Thus, engineers can formally verify systems modeled in UML activity diagrams and state machines. The result of the experimental study shows the impact of the translation in the scalability by compering different translation strategies to four model checkers: UPPAAL, PES, SPIN and NuSMV, and an application to a medical case study of an infusion pump. This work opened more research questions for me on 1) how to integrate formal verification in different phases of the development process, and 2) how to verify complex systems by analyzing the system on a higher and more scalable abstraction layer that also expresses properties of the components, which can be ensured by other verification methods.

2. **U.S. Patent US10005564B1, "Autonomous cargo handling system and method", granted June 6, 2018. Inventors: Amit Bhatia, Zamira Daw Perez, Alessandro Pinto, and Julian C. Ryde.**

   The Autonomous Cargo Handling System (ACHS) is a perfect example of a large, distributed AI-enabled CPS that consists of heterogenous subsystems that work together to achieve a common goal: move a load into a target position autonomously in the cargo area while ensuring the safety of humans. As other CPS used in the industry, ACHS has challenging requirements, such as, partial observability, certifiability, business model restrictions, limitations on space, cost and communication bandwidth. This patent presents a system architecture that addresses these challenges by constructing a distributed network of multiple CPS, which are based on different technologies, such as, perception, machine learning, knowledge reasoning, low level control, supervisory control, sensors, actuators, and humans. This work opened more research questions for me on 1) How to reason about partial knowledge and uncertainty at run-time? 2) How can we integrate certification requirements into the design and architecture of AI-enabled systems? 3) How to leverage heterogenous subsystems to achieve physical and algorithmic redundancy to increase system assurance?

3. **Zamira Daw, Scott Beecher, Michael Holloway, and Mallory Graydon, "Overarching Properties as Means of Compliance: An Industrial Case Study." IEEE/AIAA 36th Digital Avionics Systems Conference, IEEE, 2021.**

   In aerospace, certification standards ensure that a system is safe and secure for flying based on the development process of the system. These standards are not agile and do not keep up with the current technology advances, such as AI. NASA and the FAA have developed Overarching Properties (OPs) to facilitate the use of alternative approaches for system certification. In this paper, we use assurance cases (ACs) to present an argument that an alternative method to design and verify an on-board physical model used for collision detection of an UAV is certifiable. The on-board physical model is a black box, which is specified and tested against an off-line highly accurate white physics model. This approach could be extended for the certification of neural networks. This work opened more research questions for me on 1) How to use OPs to certify AI-

enabled systems by formalizing properties of the system, the development process and the training process to ensure safety, security and resilience? 2) How to automate the creation and validation of assurance cases so that they can be used at run-time for continuous certification of learning systems?