REZA SOLTANI

PhD Candidate in Formal Methods
Safety, Security, and Dependable CPS Researcher

CONTACT & CONNECT

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EDUCATION

- **PhD in Formal Methods — University of Twente**
  Sep 2022 – Aug 2026 (expected)
  Research on safety-security co-analysis for cyber-physical systems using attack-fault-defense trees, statistical model checking, and quantitative optimisation. Supervisors: Prof. dr. Mariëlle Stoelinga and Dr. Milan Lopuhaä-Zwakenberg.
- **M.Sc. Software Engineering — University of Tabriz**
  2017 – 2019
  Thesis: Privacy improvement of PeDAAC protocol for 6LoWPAN in the IoT. Supervisor: Prof. Saeid Pashazadeh.
- **B.Sc. Software Engineering — Islamic Azad University of Tabriz**
  2014 – 2017
  Thesis: Data caching based on fuzzy logic. Supervisor: Asst. Prof. Nahideh Derakhshanfard.

RESEARCH INTERESTS

Formal methods | Safety-security co-analysis | Attack-fault-defense trees | Dependable CPS | Smart grids | Satellite missions

RESEARCH PROFILE

I am a PhD candidate in formal methods at the University of Twente. My research focuses on safety-security co-analysis for cyber-physical systems, combining attack-fault-defense modelling, statistical model checking, and quantitative optimisation. My work has contributed to projects including GridShield, MISSION, CAESAR, and RUBICON, alongside research visits in Argentina and China.

ACADEMIC SNAPSHOT

- Expected PhD completion: Aug 2026.
- Research output includes 10 conference papers or accepted conference papers, 3 journal papers, and 3 preprints, including 2 papers in A-ranked ICORE/CORE conferences: DSN 2025 and CSF 2026 (accepted); Google Scholar snapshot (30 Apr 2026): 63 citations, h-index 5, i10-index 2.
- Teaching at the University of Twente: 200 hours, including 110 hours in Software Testing and Risk Assessment.
- Co-supervised 3 MSc and 2 BSc theses; all listed MSc theses were completed.
- Artifact Evaluation Committee member for FM, SPIN, and TACAS.

Academic Appointments & Research Experience

- **PhD Candidate — University of Twente**
  Sep 2022 – Present
  Research on safety-security co-analysis for cyber-physical systems through attack-fault-defense trees, statistical model checking, and quantitative optimisation, with case studies in smart grids, satellite missions, and reactor spare management. Expected completion: Aug 2026.

- **Visiting Researcher — National University of Río Cuarto, Argentina**
  22 Jun 2024 – 20 Jul 2024
  Project MISSION research secondment on spare-management optimisation for research reactors via statistical model checking, in collaboration with partners connected to INVAP-related case studies.

- **Visiting Researcher — Institute of Software, Chinese Academy of Sciences, Beijing**
  8 Apr 2025 – 7 May 2025
  Research stay on formal methods for autonomous systems, uncertainty modelling, and strategy synthesis, including collaboration with researchers at the Institute of Software, Chinese Academy of Sciences.

- **Research Visitor — Institute of Software, Chinese Academy of Sciences, Beijing**
  24 Feb 2026 – 16 Mar 2026
  Follow-up MISSION visit focused on behavioural equivalence, bisimulation reduction, attack-fault-defense trees, and statistical model checking for dependable cyber-physical systems.

- **Personal infrastructure hobby project — myhbd.net**
  Nov 2022 – Present (spare-time hobby project)
  Small self-directed hosting and server-administration playground used in my free time for Linux hardening, automation, and infrastructure experiments.

- **Researcher — University of Southern Denmark**
  Mar 2021 – Apr 2022
  Worked on trustworthy Industry 4.0 cyber-physical systems; modelled flexible production systems, analysed safety and security properties in UPPAAL SMC/Stratego, and designed controls to reduce risk from untrusted assets.

- **Research Assistant — University of Tabriz**
  Nov 2017 – Jun 2020
  Investigated IoT and 6LoWPAN security threats, proposed privacy-preserving improvements to PeDAAC, and published on opportunistic routing for constrained wireless networks.

- **IoT Researcher & Developer — Saymantech**
  Jun 2018 – Apr 2019
  Developed IoT features on Arm Mbed OS across NB-IoT, LoRaWAN, BLE, and NFC, produced reusable embedded components, and supported C/C++ development practices.

Publications

Peer-reviewed conference papers

- **R. Soltani**, M. Stoelinga, M. Lopuhaä-Zwakenberg, “Which attacks are most critical? Risk prioritization via attack tree importance measures,” accepted for *39th IEEE Computer Security Foundations Symposium (CSF, ICORE/CORE A)*, 2026.
- **R. Soltani**, S. M. Nicoletti, M. Lopuhaä-Zwakenberg, M. Stoelinga, “Querying Attack-Fault-Defense

Trees: Property Specification in Smart Grid and Aerospace Case Studies," in *2025 IEEE Annual Reliability and Maintainability Symposium - Europe (RAMS-Europe)*, 2025.

- D.-V. Copae, **R. Soltani**, M. Lopuhaä-Zwakenberg, "Attack-Defense Trees with Offensive and Defensive Attributes," in *Proc. IEEE/IFIP DSN (ICORE/CORE A)*, pp. 358–370, 2025.
- **R. Soltani**, M. Lopuhaä-Zwakenberg, M. Stoelinga, "Safety-Security Analysis via Attack-Fault-Defense Trees: Semantics and Cut Set Metrics," in *SAFECOMP*, pp. 218–232, 2024.
- **R. Soltani**, B. Ozceylan, M. Lopuhaä-Zwakenberg, C. Kolb, G. Hoogsteen, "Safety and Security Dependencies for Gridshield," in *Proc. IEEE PES ISGT Europe*, 2024.
- **R. Soltani**, M. Volk, L. Diamonte, M. Lopuhaä-Zwakenberg, M. Stoelinga, "Optimal Spare Management via Statistical Model Checking: A Case Study in Research Reactors," in *FMICS*, pp. 205–223, 2023.
- S. C. Jepsen, T. Worm, A. Johansen, S. Lazarova-Molnar, M. B. Kjærgaard, E.-Y. Kang, J. Friederich, J. E. Heredia Mena, **R. Soltani**, S. L. Sørensen, J. H. Schwee, "A Research Setup Demonstrating Flexible Industry 4.0 Production," in *ELMAR*, pp. 143–150, 2021.
- **R. Soltani**, E.-Y. Kang, J. E. Heredia Mena, "Towards Energy-aware Cyber-Physical Systems Verification and Optimization," in *Proc. FedCSIS*, pp. 205–210, 2021.
- S. Pashazadeh, L. N. Tazehkand, **R. Soltani**, "RSS_RAID a Novel Replicated Storage Schema for RAID System," in *Data Science: From Research to Application*, pp. 36–43, 2020.
- R. A. Ligvan, **R. Soltani**, S. Pashazadeh, "Distributed synchronization for charging sensors based on service priority in WSAN," in *ICCKE*, pp. 130–135, 2020.

Peer-reviewed journal articles

- **R. Soltani**, M. Volk, L. Diamonte, M. Lopuhaä-Zwakenberg, M. Stoelinga, "Optimal spare management via statistical model checking: a case study in research reactors," *Int. J. Softw. Tools Technol. Transfer*, vol. 27, no. 3, pp. 361–376, 2025.
- N. Derakhshanfard, **R. Soltani**, "Opportunistic routing in wireless networks using bitmap-based weighted tree," *Computer Networks*, vol. 188, p. 107892, 2021.
- **R. Soltani**, S. Pashazadeh, "A lightweight improvement of PeDAAC protocol for 6LoWPAN in the Internet of Things," *Multimedia Tools Appl.*, vol. 80, no. 20, pp. 31467–31486, 2021.

Preprints

- D.-V. Copae, **R. Soltani**, M. Lopuhaä-Zwakenberg, "Attack-Defense Trees with Offensive and Defensive Attributes (with Appendix)," arXiv:2504.12748, 2025.
- **R. Soltani**, P. Diale, M. Lopuhaä-Zwakenberg, M. Stoelinga, "Safety and Security Risk Mitigation in Satellite Missions via Attack-Fault-Defense Trees," arXiv:2504.00988, 2025.
- **R. Soltani**, E.-Y. Kang, J. E. Heredia Mena, "Verification and Optimization of Cyber-Physical Systems: Preprint for FedCSIS," arXiv:2109.01574, 2021.

Google Scholar: scholar.google.com/citations?user=tFbidccAAAAJ

Teaching & Supervision

TEACHING

MSc — Software Testing and Risk Assessment, University of Twente (Q3 2023/2024 & Q3 2024/2025, 110 hours)

Teaching assistant for risk assessment methods, software testing techniques, test strategies, and state machines/labelled transition systems.

BSc — Software Systems, University of Twente (Q2 2022/2023, 90 hours)

Teaching support in Java programming and software design/modelling, including UML use-case, class, sequence, and state-machine diagrams.

SUPERVISION

Co-supervision summary

Co-supervised 3 MSc theses and 2 BSc theses; all listed MSc theses were completed.

MSc — Attack-Defense Trees with Offensive and Defensive Attributes

Co-supervised Danut Copae on extending quantitative attack-defense-tree analysis with offensive and defensive attributes; this work also led to a DSN 2025 publication.

MSc — Converting Attack-Fault Trees into Markov Decision Processes for Quantitative Analysis in PRISM

Co-supervised Aleksandar Petrov on strategy-aware analysis of attack-fault scenarios through MDPs in PRISM.

MSc — Transformation of Attack-Defense Trees into 2-player Game Automata

Co-supervised Kirill Fedorov on generative translation of ADTs into PRISM/game-automata models for quantitative strategy analysis.

BSc — Optimizing Security Strategies via Game-Theoretic ADTs

Co-supervised Arsalaan Khan on cost-effective attack-defense strategy analysis with PRISM.

BSc — Modelling Cybersecurity Risks with AFTs and Game Theory

Co-supervised Lejla Skenderagić on retry-attack modelling and dynamic risk quantification in attack-fault trees.

Academic Service

- Artifact Evaluation Committee member: *FM 2024*, *SPIN 2024*, *TACAS 2025*, and *TACAS 2026*.
- Ad-hoc reviewer for journals and conferences.

Awards, Grants & Research Mobility

- Ranked 2nd among M.Sc. students in Software Engineering, University of Tabriz (2020).
- GraDAna Erasmus+ scholarship, Aristotle University of Thessaloniki (2019).
- Top 0.5% among 25,000+ in Iran's national M.Sc. entrance exam (2017).
- Summer School: Enabling Technologies for Industrial Internet of Things (ET-I2oT 2021), University of Pisa.
- Research mobility through Project MISSION / MSCA network: National University of Río Cuarto, Argentina (22 Jun 2024 – 20 Jul 2024); Institute of Software, Chinese Academy of Sciences, Beijing (8 Apr 2025 – 7 May 2025, 24 Feb 2026 – 16 Mar 2026).
- Young Researchers and Elite Club, Islamic Azad University, Tabriz Branch (2016).

References

Prof. dr. Mariëlle Stoelinga — Professor, Formal Methods & Tools group, University of Twente. m.i.a.stoelinga@utwente.nl

Dr. Milan A. Lopuhaä-Zwakenberg — Assistant Professor, Formal Methods & Tools group, University of Twente. m.a.lopuhaa@utwente.nl