



# Ehsan Poorhadi

Ph.D student in Computer Science

📅 1991 | ✉️ [poorhadi@kth.se](mailto:poorhadi@kth.se) | 🏠 <https://poorhadi.github.io> | 🌐 Poorhadi | 📺 Ehsan-Poorhadi

## About

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Educated in Mathematics and Computer Science, my interests are mathematics and logic and I enjoy working on their application in different fields.

## Work Experience

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### Ph.D Researcher in Computer Science

*Sweden*

KTH Royal Institute of Technology

2019-2024

I proposed model-based methodologies enabling analyzing the impact of cyberattacks on the safety of control systems. I incorporated semi-formal (SysML) and formal (Event-B) modeling languages in our analysis. The work resulted in two conference papers, two workshop papers, and an under-review paper.

### Master's Theses Supervisor

*Sweden*

KTH Royal Institute of Technology

2019-2024

I supervised different master's theses including:

- ML Enhanced Interpretation of Failed Test Result
- Modelling and Simulation of Complete Wheel Loader in Modelica
- Machine Learning in Predictive Maintenance of Industrial Robots
- A Holistic Framework for Analyzing the Reliability of IoT Devices
- Autonomous Control in Advanced Life Support Systems
- User Access Control Platform Based on Simple IoT Household Devices
- Program Synthesis for Data Structure Conversion in the Autonomous Mobile Industry

### Part-Time Research Assistant in Discrete Mathematics

*Iran*

Isfahan University of Technology (IUT)

2016-2018

I researched some Extremal Combinatorics problems in a group led by my master thesis supervisor. The work resulted in my first paper published in the Journal of Combinatorial Designs.

### Teacher

*Iran and Sweden*

KTH, IUT, and Isfahan Mathematics House (IMH)

2013-2024

I was a teaching assistant in different courses in Computer Science and Mathematics:

- Computer Security
- Logic for Computer Scientists
- Algorithms and Complexity
- Graph Theory
- Software Safety and Security
- Programming Techniques

I was also a math teacher at IMH, lecturing high school students.

### Member of Executive and Assessment Committee of Mathematics Competitions

*Iran*

IMH

2016-2019

I worked as a member of the organization team of two international mathematics competitions (A-lympiad and Tournament of Towns) in Iran. Some of my responsibilities were instructing graders, evaluating and shortlisting paper exams, and translating selected paper exams.

## Education

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### Ph.D. in Computer Science

KTH Royal Institution of Technology

Sweden

2019-2024

- Specialization: Formal Methods
- Thesis Title: Formal Modeling of the Impact of Cyberattacks on the Safety of Networked Control Systems
- Courses: Formal Methods, Computational Game Theory, and Cyber-Physical Systems Safety and Security
- Summer Schools: Cybersecurity and Privacy (CySep) and Role and Effects of Artificial Intelligence in Secure Applications (ARTISAN)
- Supervisors: Elena Troubitsyna and György Dán

### MS in Applied Mathematics

Isfahan University of Technology

Iran

2013 - 2016

- Specialization: Combinatorics and Graph Theory
- Thesis Title: Ad-Words and Online Matching
- Courses: Graph Theory, Probabilistic Method In Combinatorics, Computational Complexity
- Summer Schools: Workshop on Combinatorics and Graph Theory
- Graduate as a first rank based on GPA
- Supervisor: Ramin Javadi

### BS in Applied Mathematics

Azad University of Isfahan

Iran

2009 - 2013

- Graduate as a first rank based on GPA
- Courses: Advanced Programming in C++, Database Design, Operational Research, Linear Algebra, Statistics, Data Structure, Time Series, Stochastic Process

## Technical Skills

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<b>Software/System Modeling and Specification</b>	Event-B, SysML, UML, ATL, OCL, EMF, NuSMV
<b>Logics</b>	Propositional logic, Predicate logic, LTL, CTL
<b>Programming</b>	Python, C++
<b>Code Verification</b>	Frama-C, Java Path Finder
<b>Operating Systems</b>	Linux (Ubuntu), Windows
<b>Security Tools</b>	IPtable, Address Sanitizer
<b>Other Tools</b>	GitHub, LaTeX, Rodin, Gephi, Cameo Systems Modeler
<b>Languages</b>	English, Farsi

## Projects

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### Formal Modeling of HL3 Signaling System

Tools: Event-B and SysML

Sweden

2023-2024

I am building a SysML and an Event-B model of HL3 for safety analysis in the presence of cyber attacks. The project is currently ongoing.

### Formal Modeling of Moving Block Signaling System

Tools: Event-B and SysML

Sweden

2022

I construct a SysML and an Event-B model of a part of ERTMS/ETCS moving block level 3 for safety analysis in the presence of cyber attacks. I used theorem-proving techniques to prove the system's safety.

### EBSysMLSec

Languages: ATL and OCL

Sweden

2022

I developed a translation tool to convert SysML models into Event-B specification for formal analysis.

### RBC ID Block Assignment

Language: Python

Sweden

2021

I developed an optimization tool for Trafikverket to configure RBCs' ID block. In this project, György Dán and I formulated the problem as a variant of the Graph coloring problem and then I designed an algorithm to generate the optimal ID block assignment for RBCs.

## Deductive Verification of an ABS Controller

Tool: Frama-C

I annotated and verified a C implementation of an ABS controller using Frama-C.

Sweden

2020

## Model Checking of a Device Driver of a Transmitter

Tool: NuSMV

I developed a model of a transmitter in NuSMV and the device driver controlling the transmitter. We then expressed some properties in CTL and LTL and checked whether the NuSMV model satisfies them.

Sweden

2020

## Publications

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- [1] **E Poorhadi** and E Troubitsyna. “Automating an Analysis of Safety-Security Interactions for Railway Systems,” *International Conference on Reliability, Safety, and Security of Railway Systems, RSSRail*, 2023. [\[Link\]](#)
- [2] **E Poorhadi**, E Troubitsyna, G Dán. “Analysing the Impact of Security Attacks on Safety Using SysML and Event-B,” *Model-Based Safety and Assessment: 8th International Symposium, IMBSA*, 2022. [\[Link\]](#)
- [3] **E Poorhadi**, E Troubitsyna, G Dán. “Formal modeling of the impact of cyber attacks on railway safety,” *Computer Safety, Reliability, and Security. SAFECOMP Workshops: DECSoS*, 2021. [\[Link\]](#)
- [4] **E Poorhadi**, E Troubitsyna, G Dán. “Formalising the impact of security attacks on IoT safety,” *Computer Safety, Reliability, and Security. SAFECOMP Workshops: DECSoS*, 2020. [\[Link\]](#)
- [5] R Javadi, **E Poorhadi**, F Fallah. “Packing cliques in 3 uniform hypergraphs,” *Journal of Combinatorial Designs*, 2020. [\[Link\]](#)