# IVAN PEREZ

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## WORK EXPERIENCE

### Senior Computer Engineer / NASA Contractor
KBR Wyle, Mountain View, CA, USA                                                    August 2022 - Present

- Contractor assigned to NASA Ames Research Center, member of the NASA Formal Methods group.

- Software Lead of NASA's Lunar Command and Control Interoperability Project (LuCCI), leading team of 23 members (16 direct members and 7 associates) from 4 different NASA centers.

- Technical lead for runtime verification framework Copilot (NPR7150.2 Class D); lead developer responsible for coordinating several lines of work by NASA contractors, external partners, and external (open-source) contributors.

- Technical lead of the runtime monitoring application generation tool Ogma (NPR7150.2 Class D); lead contributor responsible for coordinating development and coordinating use by partners on experimental flights in collaboration with NASA Langley Research Center.

- Research on formal methods, runtime monitoring, testing, verification and validation applied to robotics and aerospace, requirements elicitation, robust software engineering; presentation of research in scientific venues.

- Technical event organization of multiple conferences, including as General Chair of the IEEE SMC-IT/SCC conference, leading team of 25 members (22 direct members and 3 external associates).

- Review of scientific papers submitted for publication in journals and conferences.

### Senior Research Scientist / NASA Contractor
National Institute of Aerospace, Hampton, VA, USA                                   January 2018 - July 2022

- Contractor assigned to NASA Langley Research Center, member of the NASA Formal Methods group.

- Technical lead for runtime verification framework Copilot (NPR7150.2 Class D); lead contributor responsible for coordinating development of several lines of work by NASA contractors, external partners, and external (open-source) contributors.

- Inventor and Technical lead of the runtime monitoring application generation tool Ogma (NPR7150.2 Class D); lead contributor responsible for coordinating development and coordinating use by partners on experimental flights in collaboration with NASA Langley Research Center.

- Research focused on swarms of distributed vehicles, autonomous aerial vehicles, and runtime monitoring.

- Research and evaluation of fault tolerance for collision detection and avoidance systems for satellites in Low-Earth Orbit (with NASA LaRC and the Air Force Research Lab).

- Co-PI of one-year DARPA-funded project to investigate the use of formal methods and category theory in combination with modeling languages for systems engineering.

- Technical event organization, and review of scientific papers submitted for publication in journals and conferences.

- Promoted 3 times during tenure.

### Teaching Assistant
University of Nottingham, Nottingham, UK                                             February 2014 - November 2016

- Duties include marking, lab assistance and preparing material. I participated in Introduction to Functional Programming (2014-2015), Programming (2014-2016), and Compilers (2014, Head T.A.).

### Founder / Software Architect / Director
Keera Studios Ltd, London, UK / Remote                                              July 2013 - December 2017

- Lead development team creating multiple multi-platform Haskell games, including the first commercial Haskell game for Android (2015) and iOS (2017).

- Original inventor of Andronaut and CuriOSity, state-of-the-art toolchains to compile/package/distribute Haskell mobile apps.

- Created Haskell Titan, a testing/debugging system specific for mobile games that records and replays game runs exactly.

- Carried out chief executive / management duties (supervision, employee training, relations with investors, relations with providers, participation in events representing company, etc.).

### Researcher / Doctoral Candidate
University of Twente, Enschede, NL                                                    May 2013 - October 2013

- Investigated limits of purely functional abstraction used by the Computer Architecture for Embedded Systems group to model and verify hybrid and cyber-physical systems (e.g. phased array antennas).

### Research Assistant
High Performance Computing Center (HLRS), Stuttgart, DE                              May 2012 - August 2012

- Developed a complete Haskell Graphical User Interface for SoOSim, a simulator of supercomputer operating systems, as part of the S(o)OS project funded by the European Commission.

- Assisted project partners in technical evaluation of the SoOS project and presentation of work to the European Commission (through 2013).

### Consultant / Software Developer
Self-employed, Coventry, UK                                                          July 2011 - July 2013

- Meet with customers to capture project requirements, and determine project development plan.

- Developed multiple compilers, debuggers, rule-based systems, formal reasoning frameworks, game engines, game IDEs and mobile apps in several languages (including Haskell, Prolog, Idris, Scala, Java and C), either fully subcontracted or integrated as part of customer's development team.

- Note: Work performed full time, except where I had another full-time occupation at the same time (i.e., May - July 2013).

### Researcher
IMDEA Software Institute, Madrid, ES                                              October 2007 - December 2009

- Lead research activities to formalize component-based mash-ups using Description Logics and extensions of semantic web frameworks.

- Extended Description Logics with ontology parameters; implemented plug-ins for reasoning tools.

- Present research results to project partners and scientific community.

- Participated in elaborating project proposals successfully funded by the Ministry of Industry.

### Research Associate
BABEL Research Group - UPM, Madrid, ES                                              April 2003 - March 2010

- Co-lead software development of MTP, a parser/scanner/AST generator written in Java targeting Java and Haskell (team of 9 people).

- Developed compiler frontend for SLAM-SL, an object-oriented specification language, written in Haskell; used the B-method to specify and prove system properties.

- Carried out supervision and training of interns and students, writing scientific papers, participating in conference review committees, presenting work at scientific conferences, proposing new research directions, and contributing to grant proposals.

- Note: The level of dedication/retribution changed over the years, with periods being full-time (mainly Sep 2005-Sep 2007) and others part-time (outside the aforementioned period).

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## EDUCATION

### PhD in Computer Science
University of Nottingham, Nottingham, UK                                                    November 2017

- Dissertation Topic: "Extensible and Robust Functional Reactive Programming"

- Supervisors: Henrik Nilsson, Graham Hutton

### MSc., European Master in Computational Logic
Technical University of Madrid                                                              September 2009

- Dissertation Topic: "Gadget composition and automatic discovery in EzWeb"

• Supervisors: Susana Munoz Hernandez

**Engineer in Computer Science**
Technical University of Madrid                                                        September 2008

• Dissertation Topic: "A formalization of parametric context-free grammars"

• Supervisors: Angel Herranz Nieva

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## SELECTED PUBLICATIONS

• Ivan Perez, Klaus Havelund and Jyo Deshmukh. *Selected Extended Papers of NFM 2022*. Journal of Innovations in Systems and Software Engineering. April 2024. (As Editor; Accepted; Awaiting publication).

• Irfan Sljivo, Ivan Perez, Anastasia Mavridou, Johann Schummann, Pavlo Vlastos, Corey Carter. *Dynamic Assurance of Autonomous Systems through Ground Control Software*. AIAA Scitech 2024 Forum. Orlando, Florida. January 2024.

• Aaron Dutle, Mariano Moscato, Laura Titolo, Cesar Munoz, Ivan Perez. *Selected Extended Papers of NFM 2021*. Journal of Innovations in Systems and Software Engineering. December 2023. (Editor).

• Ryan Scott, Mike Dodds, Ivan Perez, Alwyn Goodloe, Robert Dockins. *Trustworthy Runtime Verification via Bisimulation (Experience Report)*. 28th ACM SIGPLAN International Conference on Functional Programming (ICFP 2023). September 2023.

• Segev Elazar Mittelman, Aviel Resnick, Ivan Perez, Alwyn Goodloe, Leonidas Lampropoulos. *Don't Go Down the Rabbit Hole: Reprioritizing Enumeration for Property-Based Testing*. 16th ACM SIGPLAN International Haskell Symposium. September 2023.

• Ivan Perez, Frank Dedden. *The Essence of Reactivity*. 16th ACM SIGPLAN International Haskell Symposium. September 2023.

• Ivan Perez. *The Beauty and Elegance of Functional Reactive Animation*. 11th ACM SIGPLAN International Workshop on Functional Art, Music, Modelling and Design (FARM). September 2023.

• Ivan Perez. *Types that Change: The Extensible Type Design Pattern*. ACM SIGPLAN Workshop on Functional Software Architecture - FP in the Large. September 2023.

• Thomas Pressburger, Anastasia Mavridou, Ivan Perez, Alwyn Goodloe, Peter Mehlitz, Dennis Volpano, Hannah Walsh. *Wildfire-fighting Use Case REquirements to Monitor*. NASA Technical Manual - NASA/TM-2023-0010160. April 2023.

• Ivan Perez, Anastasia Mavridou, Thomas Pressburger, Alexander Will, Patrick Martin. *Monitoring ROS2: from Requirements to Autonomous Robots*. 4th Workshop on Formal Methods for Autonomous Systems. September 2022.

• Ivan Perez, Anastasia Mavridou, Thomas Pressburger, Alwyn Goodloe, Dimitra Giannakopoulou. *Automated Translation of Natural Language Requirements to Runtime Monitors*. 28th International Conference on Tools and Algorithms for the Construction and Analysis of Systems. April 2022.

• Ivan Perez, Anastasia Mavridou, Thomas Pressburger, Alwyn Goodloe, Dimitra Giannakopoulou. *Integrating FRET with Copilot: Automated Translation of Natural Language Requirements to Runtime Monitors*. NASA Technical Manual - NASA/TM-2022-0000049. February 2022.

• Aaron Dutle, Cesar Munoz, Esther Conrad, Alwyn Goodloe, Laura Titolo, Ivan Perez, Swee Balachandran, Dimitra Giannakopoulou, Anastasia Mavridou, Thomas Pressburger. *From Requirements to Autonomous Flight: An Overview of the Monitoring ICAROUS Project*. In Proceedings Second Workshop on Formal Methods for Autonomous Systems, EPTCS 329. December 2020.

• Ivan Perez, Henrik Nilsson. *Runtime Verification and Validation of Functional Reactive Systems*. Journal of Functional Programming. August 2020.

• Ivan Perez, Alwyn Goodloe. *Fault-Tolerant Functional Reactive Programming (Extended Version)*. Journal of Functional Programming. May 2020.

• Ivan Perez, Frank Dedden, Alwyn Goodloe. *Copilot 3*. NASA Technical Manual - NASA/TM-2020-220587. April 2020.

• Christina Zeller, Ivan Perez. *Mobile Game Programming in Haskell*. FARM 2019, co-located with ICFP 2019. August 2019.

- Ivan Perez, Alwyn Goodloe, William Edmonson. *Fault-Tolerant Swarms*. IEEE International Conference on Space Mission Challenges for Information Technology. Pasadena, CA. July 2019.

- Kerianne L. Hobbs, Ivan Perez, Aaron W. Fifarek, Eric M. Feron. *Formal Verification of Decision Logic for Automatic Maneuvering of Spacecraft*. AIAA Scitech 2019 Forum. San Diego, California. January 2019.

- Manuel Baerenz, Ivan Perez. *Rhine - FRP with Type-level Clocks*. Haskell Symposium 2018, co-located with ICFP 2018. September 2018.

- Ivan Perez. *Fault Tolerant Functional Reactive Programming*. ICFP 2018. September 2018.

- Ivan Perez. *GALE: A Functional Graphic Adventure Library and Engine*. FARM 2017, co-located with ICFP 2017. September 2017.

- Ivan Perez. *Back to the Future: Time Travel in FRP*. Haskell Symposium 2017, co-located with ICFP 2017. September 2017.

- Ivan Perez, Henrik Nilsson. *Testing and Debugging Functional Reactive Programming*. ICFP 2017. September 2017.

- Ivan Perez, Manuel Baerenz, Henrik Nilsson. *Functional Reactive Programming, refactored*. Haskell Symposium 2016, co-located with ICFP 2016. September 2016.

- Ivan Perez, Henrik Nilsson. *Bridging the GUI gap with Reactive Values and Relations*. Haskell Symposium 2015, co-located with ICFP 2015. September 2015.

- Henrik Nilsson, Ivan Perez. *Declarative Game Programming*. 16th International Symposium on Principles and Practice of Declarative Programming (PPDP 2014). September 2014.

- Ivan Perez, Oscar Corcho. *Pattern Definitions and Semantically Annotated Instances*. Workshop on Ontology Patterns, co-located with 8th International Semantic Web Conference. October 2009.

- Oscar Corcho, Catherine Roussey, Luis Vilches, Ivan Perez. *Pattern-based OWL Ontology Debugging Guidelines*. In Workshop on Ontology Patterns (WOP 2009), collocated with the 8th International Semantic Web Conference (ISWC-2009), CEUR Workshop proceedings, pages 68-82. October 2009.

- Jesus Martinez, Ivan Perez, Susana Munoz, and Daniel Lancho. *Thin client technology in the academic environment*. In IV Congreso Universidad y Cooperacion al Desarrollo, Barcelona, Spain. November 2008.

- Ivan Perez, Angel Herranz, Susana Munoz, Juan Jose Moreno-Navarro. *Modelling mash-up resources*. 13th Conference on Software Engineering and Databases (JISBD 08). October 2008.

- Ivan Perez. *Method for automatic secure retrieval of Trusted Public Keys*. First Spanish Conference on Informatics (CEDI), Information Security Symposium. September 2005. (In Spanish.)

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## SELECTED PRESENTATIONS

- *Keynote: Runtime Programming with Copilot and Ogma*. Zurihac. June 2024. (Upcoming.)

- *Invited Talk: Runtime Monitoring with Copilot and Ogma*. Scale by the Bay. November 2023.

- *Invited Session: Learn from a Leader*. The University of Nottingham. November 2023.

- *The Road to Safe Space Exploration*. ELISA: Enabling Linux in Safety Applications. November 2023.

- *Panel on Space ROS*. 2nd Open Source for Space Workshop. July 2023.

- *The Future of Space Robotics Panel*. 2023 SMC-IT/SCC Workshop on Space Robotics Software. July 2023.

- *NPR7150 - Lessons learned from the Ogma and Copilot projects*. NASA Ames Research Center. April 2023.

- *A lightweight software development method*. NASA Ames Research Center. April 2023.

- *Runtime Verification of Autonomous Systems*. NASA Ames Science and Technology Workshop. February 2023.

- *Invited Talk: Runtime Verification with Copilot 3 and Ogma*. University of California, Santa Cruz. January 2023.

- *Invited Talk: Runtime Verification with Copilot 3 and Ogma*. Iowa State University. July 2022.

- *Copilot: A tutorial*. Virginia Commonwealth University (VCU). June 2022. With Alwyn Goodloe (NASA).

- *Invited Lecture: Practice Requirements, Requirements in Practice*. Requirements Engineering. University FH Voralberg, Austria. June 2022.

- *Runtime Verification with Copilot 3 and Ogma*. NASA Jet Propulsion Laboratory. May 2022.

- *Invited Talk: Runtime Verification with Copilot 3 and Ogma*. University of Southern California. May 2022.

- *Invited Lecture: Functional Reactive Programming in the Real World*. Haskell in Industry Session - Concepts of Higher Programming Languages. University FH Voralberg, Austria. January 2022.

- *Invited Lecture: Practice Requirements, Requirements in Practice*. Requirements Engineering. University FH Voralberg, Austria. June 2021.

- *Invited Lecture*. CS141-15 Functional Programming. University of Warwick, UK. February 2021.

- *Invited Lecture: Functional Reactive Programming in the Real World*. Haskell in Industry Session - Concepts of Higher Programming Languages. University FH Voralberg, Austria. January 2021.

- *Invited Talk: Runtime Verification with Copilot 3*. Second Workshop on Formal Methods for Autonomous Systems. Virtual. December 2020.

- *Testing and Extending Functional Reactive Systems*. Galois, Inc. Arlington, VA. January 2020.

- *Keynote: Streams, Reactivity and FRP: where we are, where to go*. Workshop on Reactive and Event-based Languages and Systems (REBLS 2019). Athens, Greece. October 2019.

- *Introduction to Functional Programming*. Netflix. Los Gatos, CA. December 2018.

- *Functional Abstractions for Robust and Fault Tolerant Reactive Systems*. National Institute of Aerospace. Hampton, VA. May 2018.

- *Reactive Programming with Monadic Stream Functions*. NASA Langley Research Center - Formal Methods Group - Informal Friday Lunch Talk series. May 2018.

- *Keynote: Extensible Functional Reactive Programming Applied to iOS and Android Game Programming*. Haskell in Leipzig. October 2017.

- *Lightning talk: Our Tools for Mobile Haskell Games and Apps*. Haskell eXchange. October 2017.

- *Haskell Games and Apps for iOS and Android*. Commercial Users of Functional Programming - Co-located with ICFP 2017. September 2017.

- *Game programming in Haskell*. Functional Programming Meetup Group, Kyiv, Ukraine. April 2016.

- *Game programming in Haskell: baby steps*. University of Bamberg. February 2016.

- *Haskells ultimate challenge: game programming for fun and profit*. Haskell eXchange. October 2015.

- *Haskell Game Development from Zurich to London*. Haskell Meetup Group, London. June 2015.

- *Game Programming in Haskell*. Technical University of Madrid. April 2015.

- *Lightning Talk: Keera Studios - Game Programming in Haskell with FRP*. FP Days, London. November 2014.

- *Functional Games, Reactivity and UIs*. Haskell Meetup Group, London. June 2014.

- *Lightning Talk: Game Programming in Haskell*. Midlands Graduate School. Nottingham, UK. April 2014.

- *An exploration of Functional Reactive Programming*. University of Twente. September 2013.

- *Reactive Programming with Reactive Values*. University of Twente. March 2013.

- *Reactive Programming in Haskell*. Technical University of Madrid. December 2011.

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## PARTICIPATION IN CONFERENCES AND EVENTS

- *Space Mission Challenges for Information Technology (SMC-IT) / Space Computing Conference (SCC)*. General Chair. July 2024. (Upcoming)

- *3rd Open Source for Space Workshop*. Co-Chair. July 2024.

- *NASA Formal Methods Symposium 2024*. PC Member. June 2024. (Upcoming)

- *ACM SIGPLAN Workshop on Functional Software Architecture*. PC Member. September 2023.

- *2nd Open Source for Space Workshop*. Co-Chair. July 2023.

- *Space Mission Challenges for Information Technology (SMC-IT)*. PC Chair. July 2023.

- *NASA Formal Methods Symposium 2023*. PC Member, Session Chair. May 2023.

- *4th Workshop on Formal Methods for Autonomous Systems*. PC Member. September 2022.

- *PhD Symposium, 17th International Conference on integrated Formal Methods (iFM)*. PC Member. June 2022.

- *NASA Formal Methods Symposium 2022*. General/Program Co-Chair. May 2022.

- *27th International Conference on Tools and Algorithms for the Construction and Analysis of Systems*. External Reviewer. March 2022.

- *3rd Workshop on Formal Methods for Autonomous Systems*. PC Member. October 2021.

- *Space Mission Challenges for Information Technology (SMC-IT)*. PC Co-Chair; Organization Committee Member. July 2021.

- *NASA Formal Methods Symposium 2021*. General Co-Chair. May 2021.

- *2nd Workshop on Formal Methods for Autonomous Systems*. PC Member. December 2020.

- *Workshop on Reactive and Event-based Languages and Systems*. General Chair; Program Chair. November 2020.

- *International Conference of Functional Programming 2020*. External Review Committee Member. August 2020.

- *NASA Formal Methods 2020*. External Reviewer. January 2020.

- *Workshop on Reactive and Event-based Languages and Systems*. PC Member. October 2019.

- *International Symposium on Haskell*. PC Member. August 2019.

- *NASA Formal Methods 2019*. Reviewer. May 2019.

- *Innovations in Systems and Software Engineering - A NASA Journal*. Reviewer. August 2019.

- *Programming Languages Mentoring Workshop @ ICFP 2018*. Member of Discussion Panel. September 2018.

- *International Workshop on Functional Arts, Programming, Modeling and Design*. PC Member. September 2018.

- *International Conference of Functional Programming 2018*. Artifact Evaluation Committee Member. September 2018.

- *Tenth NASA Formal Methods Symposium 2018*. Session Chair. April 2018.

- *International Workshop on Functional Art, Music, Modelling and Design*. PC Member; Session Chair. September 2017.

- *Zurihac - Haskell Hackathon*. HSR Hochschule fur Technik Rapperswil, Zurich. June 2017.

- *Women in Technology Nottingham*. University of Nottingham. February 2017.

- *Women in Technology Nottingham*. University of Nottingham. February 2016.

- *Zurihac - Haskell Hackathon*. Google Zurich. June 2015.

- *WarwickHack*. University of Warwick. March 2015.

- *Nottingham FPLab Away Day*. Main chair / event coordinator. 2014.

- *Hacknotts*. University of Nottingham. Hackathon winner, with M. Baerenz. November 2014.

- *Fun at Facebook – Fun in the Afternoon*. Facebook London. March 2014.

- *International Conference on Logic Programming*. External Reviewer. December 2008.

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## AWARDS

- *NASA Group Achievement Award (ATTRACTOR project), 2023*.

- *University of Nottingham Alumni Award (aka Alumni Laureate Awards) - Nomination*.

- *DoD Defense Advanced Research Projects Agency (DARPA) Grant. Co-Principal Investigator. Grant Number: N660011914037; Grant Award: 193,089 USD; July 2019 - September 2020*.

- *SIGPLAN Professional Activities Committee Grant Award, 2019.*
- *SIGPLAN Professional Activities Committee Grant Award, 2018.*
- *SIGPLAN Professional Activities Committee Grant Award, 2017.*
- *SIGPLAN Professional Activities Committee Grant Award, 2016.*
- *SIGPLAN Professional Activities Committee Grant Award, 2015.*
- *Top-10 finalist, prize winner, Tech Start-up Programme, Technical University of Madrid, 2008.*
- *Top-25 finalist, Tech Start-up Programme, Comunidad de Madrid, 2006.*

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## OPEN SOURCE PROJECTS

- *Space ROS (member of steering committee and technical committee)*: Robot Operating System distribution adapted for space applications.
- *NASA Ogma (creator, technical lead)*: Runtime Verification framework for flight and robotics applications.
- *Copilot (technical lead, developer)*: Domain-specific language for runtime verification targeting C99.
- *Dunai (creator, developer)*: Haskell FRP eDSL using Monadic Stream Functions.
- *Yampa (maintainer)*: Haskell eDSL for pure Arrowized Functional Reactive Programming.
- *Haskanoid (creator, developer)*: Haskell game for PC, Mac, web, Android, iOS, supporting Kinect/Wiimote.
- *Keera Hails (creator, developer, 2011 - 2017)*: Reactive Haskell library supporting GTK+, HTML, Android/iOS, sockets, FRP.
- *Keera Posture (creator, developer, 2011 - 2017)*: Haskell app that uses the webcam to prevent RSI.

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## VOLUNTEERING

TEDECO cooperation group                                    May 2007 - January 2010
- Systems administrator of teaching platform at University of Ngozi. Included stay in Burundi.

Seis do Nadal                                              September 1999 - June 2001
- Basketball Coach: Assistant Coach (1999-2000) and First Coach (2000-2001).

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## LANGUAGES

English (fluent), Spanish (fluent), Galician (fluent), Portuguese (advanced), Italian (intermediate), Ukrainian (intermediate), French (elementary)

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## CERTIFICATIONS

- Open Water Diver
- Accelerated Freefall Skydiving

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## WORK PERMITS

- **USA**: Green Card (LPR) / No restrictions
- **EU/EEA**: Citizen / No restrictions