

Alessandro Pinto

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Experience

Autonomy Assurance Lead

NASA Jet Propulsion Laboratory, Pasadena, CA (August 2022)

Associate Adjunct Professor

University of California, Santa Cruz (July 2022 - July 2024)

Technical Fellow, Embedded Autonomy

Raytheon Technologies Research Center, Berkeley, CA (April 2018 – June 2022)

Definition of multi-year research and development roadmaps; technical oversight of research projects; transition of technologies from research to product; mentoring and developing talent; outreaching and maintaining a network of collaborators in academia and research laboratories; publishing high-quality articles in conferences and journals.

Associate Director, Research, Autonomous and Intelligent Systems

United Technologies Research Center, Berkeley, CA (October 2014 – April 2017)

Development of technical roadmaps in the specific areas of knowledge acquisition, reasoning methods, and architectural design of distributed autonomous and intelligent systems; coordinating the transition of technology to business units; proposal writing and project execution.

Staff Scientist/Engineer, Autonomous and Intelligent Systems /Design Methods

United Technologies Research Center, Berkeley, CA (June 2008 – October 2014)

Technical lead for the development of computer automation technologies including algorithms and tools for system design, verification, reasoning, decision-making, and run-time management. External and internal marketing of new concepts, proposal writing, technical project execution and development of complex software systems. Publication of research results in conference and journal papers.

System Designer (Self-employed)

Rome, Italy (March 2000 – July 2001)

Implementation of system level models of wireless communication systems (customer: Ericsson Lab Italy).

System-on-Chip Designer

Consultant for Ericsson Lab Italy, Rome, Italy (March 1999 – March 2000)
Hardware design of components to be integrated into large System-on-Chips; co-simulation of hardware and firmware; testing and validation.

Education

Ph.D. in Electrical Engineering and Computer Sciences (May 2008)

University of California, Berkeley

“A Platform-Based Approach to Communication Synthesis for Embedded Systems”

Laurea in Electrical Engineering, Summa Cum Laude (1999) University of Rome “La Sapienza”, Rome, Italy

Design and Implementation of digital receivers for 2/4/8PSK - 16/32/64QAM Trellis-Coded Signals

Awards

National Academy of Engineering, Frontiers of Engineering Alumnus (2019)

United Technologies Research Center Technical Excellence Award (2017)

Given to one individual as recognition of technical excellence.

United Technologies Corporation Outstanding Achievement Award (2015)

Contribution to autonomous vertical flight.

Projects

Safe Aviation Autonomy with Learning-enabled Components in the Loop: from Formal Assurances to Trusted Recovery Methods (Principal Investigator for RTRC)

Funded by NASA, 2020 – 2022. In collaboration with MIT, Georgia Tech, Stanford (Prime), MIT Lincoln Laboratory, University of New Mexico, Hampton University, UC Berkeley. Development of compositional analysis methods for autonomous systems.

HERMES: Hybrid Efficient Reasoning Method for Explainable and Scalable formal methods (Principal Investigator)

Funded by DARPA I2O under the “Cyber-Assured Systems Engineering (CASE)” program, 2018 – 2022

Development of a rigorous modeling and analysis system bridging the gap between high-level design languages and back-end analysis tools via an intermediate representation; implementation of decomposition approaches for scalability; implementation of explanation methods lifting analysis results to design domain tools.

Autonomous Cargo Handling System (Principal Investigator)
Joint with Collins Aerospace (January 2016 – Present) Development of perception and control architecture and algorithms for introducing intelligence and automation in current cargo handling systems. (Patent #US10005564)

Autonomous Crew Enhancement System (Principal Investigator for UTRC)
Funded by DARPA TTO under “Aircrew Labor In-Cockpit Automation System (ALIAS)”, in collaboration with Sikorsky Aircraft Corporation (2015– 2019)
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.

Architectures and Algorithms for Autonomous Systems (Principal Investigator)
Funded by the United Technologies Research Center (2011 – Present)
Responsible for the definition of a platform-agnostic and scalable architecture for autonomous systems: design tools (software design and knowledge capturing), logic reasoning and A.I. planning algorithms, contingency management.

Modeling and Verification of Human-Machine Systems (Principal Investigator)
Funded by the United Technologies Research Center (2014) and the Office of Naval Research (2015-2019)
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 autonomous and intelligent systems.

Distributed Intelligence (Principal Investigator) *Funded by the United Technologies Research Center (2015 – Present)*
Software architectures, implementation and evaluation of decentralized perception and decision making in operational systems.

Contract-Based Development and Deployment (Principal Investigator)
Funded by DARPA STO under the “Communication in Contested Environments (C2E)” program (2014 – 2017)
Development of a new design and deployment system based on the notion of component contracts; management of software deliverables to the Government.

Complex System Design and Analysis (Co-Principal Investigator)
Funded by DARPA TTO under the “Adaptive Vehicle Make” program (Sept. 2010 – Sept. 2011)
Developed a large set of tools for the specification of systems, the automatic generation of design alternatives, and the evaluation of complexity metrics with applications to Unmanned Aerial Vehicles.

Stochastic Analysis and Design of Systems (Principal Investigator)
Funded by DARPA TTO (May 2010 – May 2011)
Development of a software library for the simulation and verification of Discrete

Time Stochastic Hybrid Systems.

Stochastic Analysis and Design of Networked Systems (*Principal Investigator*)

Funded by the United Technologies Research Center (2009 – 2010)

Development of methods for the analysis of distributed control algorithms subject to uncertainty in communication and computation delays, as well possibly other sources of uncertainty due to environmental conditions

Communication Synthesis Infrastructure (*Main developer*)

University of California, Berkeley (2005-2008)

Developed a complete infrastructure for the specification of communication network optimization problems, and a set of optimization algorithms for their solution.

Patents

[4] Zamira A. Daw Perez, Alessandro Pinto, Richa Varma, Xiaobin Zhang, Binu M. Nair, Self Calibrating Multi-Sensor Cargo Handling System and Method, (Patent number to be assigned), 2021.

[3] Zamira A. Daw Perez, Alessandro Pinto, Richa Varma, Xiaobin Zhang, Binu M. Nair, Autonomous system for air cargo end-to-end operations, US10994865B2, 2021.

[2] Zamira A. Daw Perez, Alessandro Pinto, Richa Varma, Binu M. Nair, Xiaobin Zhang, Aaron J Roberts, and Scott Harms, On-board unit load device weight estimation, US10782179B2, 2020.

[1] Amit Bhatia, Zamira Daw Perez, Alessandro Pinto, Julian C. Ryde, Autonomous cargo handling system and method, US10005564B1, 2018.

[US-2020122834-A1 (pending)], “Multi-robots system for cargo handling”

[US-2021316864-A1 (pending)], Distributed control of autonomous cargo handling systems

[US-2021316862-A1 (pending)] Systems and methods for run-time self-assessment of cargo handling systems

[US-2021318668-A1 (pending)] Systems and methods for operating multiple-level autonomous cargo handling systems

[US-2021319683-A1 (pending)] Real-time communication link with a cargo handling system

[US-2021316863-A1 (pending)] Systems and methods for safely operating autonomous cargo handling systems

[US-2021319397-A1 (pending)] Real-time tracking of cargo loads

Publications

- [P2] Dimitrii Kirov, Mohamed Wahbi, Alessandro Pinto. “Automated Hybrid Reasoning” (in preparation)
- [P1] Abdelilah Sakti, Alessandro Pinto, Ayman Elkfrawy. “Mining Solver-Failures for Explanation Generation in Constraint Solving” (in preparation)
- [S1] Timothy Wang, Alessandro Pinto. “Survey of Human Models for Verification of Human-Machine Systems.” (Submitted to the IEEE Transactions on Human-Machine Systems)
- [51] Timothy Wang, Zamira Daw, Pierluigi Nuzzo and Alessandro Pinto. “Hierarchical Contract-based Synthesis for Assurance Cases”. *NASA Formal Methods, 14th International Symposium, Pasadena, CA, May 24-27 (NFM2022)*
- [50] Pinto, Alessandro. “Analysis and Design of Uncertain Cyber-Physical Systems.” in *“Computation-Aware Algorithmic Design for Cyber-Physical Systems”, Birkhauser, 2021.*
- [49] Pinto, Alessandro. “Requirement Specification, Analysis and Verification for Autonomous Systems.” *Proceedings of the Design Automation Conference (Special Session on “Design Automation for Autonomous and Intelligent Systems”, short paper) (2021)*
- [48] Bhatia, Amit, and Alessandro Pinto. “Automated Construction of Knowledge-Bases for Safety Critical Applications: Challenges and Opportunities.” *Proceedings of the AAAI 2021 Spring Symposium on Combining Machine Learning and Knowledge Engineering (AAAI-MAKE) (2021)*
- [47] Pinto, Alessandro. “An Open and Modular Architecture for Autonomous and Intelligent Systems.” *IEEE International Conference on Embedded Software and Systems (Invited Paper) (2019).*
- [46] Jha, Susmit, Tuhin Sahai, Vasumathi Raman, Alessandro Pinto, and Michael Francis. “Explaining AI Decisions Using Efficient Methods for Learning Sparse Boolean Formulae.” *Journal of Automated Reasoning* (2018): 1-21.
- [45] Jha, Susmit, Vasumathi Raman, Alessandro Pinto, Tuhin Sahai, and Michael Francis. “On learning sparse boolean formulae for explaining AI decisions.” In *NASA Formal Methods Symposium*, pp. 99-114. Springer, Cham, 2017.
- [44] Pinto, Alessandro, and Alberto L. Sangiovanni Vincentelli. “CSL4P: A Contract Specification Language for Platforms.” *Systems Engineering* 20, no. 3 (2017): 220-234.
- [43] Srivastava, Siddharth, Stuart Russell, and Alessandro Pinto. “Metaphysics of planning domain descriptions.” In *2015 AAAI Fall Symposium Series*. 2015.
- [42] Ding, Xuchu Dennis, Brendan Englot, Alessandro Pinto, Alberto Speranza, and Amit Surana. “Hierarchical multi-objective planning: From mission

- specifications to contingency management.” In *IEEE international conference on robotics and automation (ICRA)*, pp. 3735-3742. IEEE, 2014.
- [41] Pinto, Alessandro, George Mathew. “Computing Probability Distributions over a Hybrid State Space: Case Study and Practical Limitations”, *Workshop on Applied Verification for Continuous and Hybrid Systems*, 2014
- [40] Xu, Songyan, Ratnesh Kumar, and Alessandro Pinto. “Correct-by-construction and optimal synthesis of beacon-enabled ZigBee network.” *IEEE Transactions on Automation Science and Engineering* 10, no. 1 (2013): 137-144.
- [39] Guo, Liangpeng, Alberto Sangiovanni Vincentelli, and Alessandro Pinto. “A complexity metric for concurrent finite state machine based embedded software.” In *2013 8th IEEE International Symposium on Industrial Embedded Systems (SIES)*, pp. 189-195. IEEE, 2013.
- [38] Ding, Xu Chu, Alessandro Pinto, and Amit Surana. “Strategic planning under uncertainties via constrained markov decision processes.” In *2013 IEEE International Conference on Robotics and Automation*, pp. 4568-4575. IEEE, 2013.
- [37] Cherepinsky, I., and A. Pinto. “Stringent safety design and verification methods for VTOL unmanned aerial vehicles.” In *Proceedings of the American Helicopter Society 68th Annual Forum*, Fort Worth, TX. 2012.
- [36] Pinto, A. “Methods and tools to enable the design and verification of intelligent systems.” *AIAA Infotech at Aerospace*, 2012.
- [35] Leonardi, Francesco, Alessandro Pinto, and Luca P. Carloni. “Synthesis of distributed execution platforms for cyber-physical systems with applications to high-performance buildings.” In *-2011 IEEE/ACM Second International Conference on Cyber-Physical Systems*, pp. 215-224. IEEE, 2011.
- [34] Mathew, G. and Pinto, A. “Stochastic Analysis and Design of Systems.” *Final Report for the V2D2 DARPA Study FA9550-10-C-0116*, 2011.
- [33] Banaszuk, Andrzej, Vladimir A. Fonoberov, Thomas A. Frewen, Marin Kobilarov, George Mathew, Igor Mezić, Alessandro Pinto et al. “Scalable approach to uncertainty quantification and robust design of interconnected dynamical systems.” *Annual Reviews in Control* 35, no. 1 (2011): 77-98.
- [32] Cizelj, Igor, Xu Chu Dennis Ding, Morteza Lahijanian, Alessandro Pinto, and Calin Belta. “Probabilistically safe vehicle control in a hostile environment.” *IFAC Proceedings Volumes* 44, no. 1 (2011): 11803-11808.
- [31] Maasoumy, Mehdi, Alessandro Pinto, and Alberto Sangiovanni-Vincentelli. “Model-based hierarchical optimal control design for HVAC systems.” *ASME Dynamic Systems and Control Conference*, 2011.
- [30] Mozumdar, M., Alberto Puggelli, Alessandro Pinto, Luciano Lavagno, and Alberto L. Sangiovanni-Vincentelli. “A hierarchical wireless network architec-

ture for building automation and control systems.” In *Proceedings of the 7th International Conference on Networking and Services (ICNS)*. 2011.

[29] Mathew, George, and Alessandro Pinto. “Optimal design of a class of hybrid systems with uncertain parameters.” In *2011 50th IEEE Conference on Decision and Control and European Control Conference*, pp. 539-544. IEEE, 2011.

[28] Carloni, Luca P., Andrew B. Kahng, Swamy V. Muddu, Alessandro Pinto, Kambiz Samadi, and Puneet Sharma. “Accurate predictive interconnect modeling for system-level design.” *IEEE transactions on very large scale integration (VLSI) systems* 18, no. 4 (2010): 679-684.

[27] Pinto, Alessandro, Sudha Krishnamurthy, and Suresh Kannan. “A model-based end-to-end toolchain for the probabilistic analysis of complex systems.” In *2010 IEEE International Conference on Automation Science and Engineering*, pp. 994-1000. IEEE, 2010.

[26] Yang, Yang, Alessandro Pinto, Alberto Sangiovanni-Vincentelli, and Qi Zhu. “A design flow for building automation and control systems.” In *2010 31st IEEE Real-Time Systems Symposium*, pp. 105-116. IEEE, 2010.

[25] Mathew, George, and Alessandro Pinto. “Markov modeling of stochastic hybrid systems.” In *2010 48th Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, pp. 1707-1713. IEEE, 2010.

[24] Pinto, Alessandro, and Sudha Krishnamurthy. “Developing design tools for uncertain systems in an industrial setting.” In *2010 48th Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, pp. 1714-1721. IEEE, 2010.

[23] Becz, Sandor, Alessandro Pinto, Lawrence Zeidner, Ritest Khire, Hayden Reeve, and Andrzej Banaszuk. “Design system for managing complexity in aerospace systems.” In *10th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference*, p. 9223. 2010.

[22] Pinto, Alessandro, Sandor Becz, and Hayden Reeve. “Correct-by-construction design of aircraft electric power systems.” In *10th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference*, p. 9263. 2010.

[21] Surana, Amit, and Alessandro Pinto. “Analysis of Stochastic Automata Networks using copula functions.” In *2010 48th Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, pp. 1699-1706. IEEE, 2010.

[20] Pinto, Alessandro, Ratnesh Kumar, and Songyan Xu. “Synthesis of wireless time-triggered embedded networks for networked control systems.” (<https://ieeexplore.ieee.org/abstract/document/5234116>) In *2009 IEEE International Conference on Automation Science and Engineering*, pp. 397-402. IEEE, 2009.

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- In *Proceedings of the Conference on Design, Automation and Test in Europe*, pp. 1006-1011. European Design and Automation Association, 2009.
- [18] Pinto, Alessandro, Luca P. Carloni, and Alberto L. Sangiovanni-Vincentelli. "A methodology for constraint-driven synthesis of on-chip communications." *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* 28, no. 3 (2009): 364-377.
- [17] Pinto, Alessandro, Massimiliano D'Angelo, Carlo Fischione, Eelco Scholte, and Alberto Sangiovanni-Vincentelli. "Synthesis of embedded networks for building automation and control." In *2008 American Control Conference*, pp. 920-925. IEEE, 2008.
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- [13] Davare, Abhijit, Douglas Densmore, Trevor Meyerowitz, Alessandro Pinto, Alberto Sangiovanni-Vincentelli, Guang Yang, Haibo Zeng, and Qi Zhu. "A next-generation design framework for platform-based design." In *Conference on using hardware design and verification languages (DVCon)*, vol. 152. 2007.
- [12] Pinto, Alessandro, Luca P. Carloni, and Alberto L. Sangiovanni-Vincentelli. "A communication synthesis infrastructure for heterogeneous networked control systems and its application to building automation and control." In *Proceedings of the 7th ACM & IEEE international conference on Embedded software*, pp. 21-29. ACM, 2007.
- [11] Pinto, Alessandro, Luca P. Carloni, Roberto Passerone, and Alberto Sangiovanni-Vincentelli. "Interchange semantics for hybrid system models." *Proc. of 5th MATHMOD* (2006).
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- [6] Pinto, Alessandro, Alberto L. Sangiovanni-Vincentelli, Luca P. Carloni, and Roberto Passerone. “Interchange formats for hybrid systems: Review and proposal.” In *International Workshop on Hybrid Systems: Computation and Control*, pp. 526-541. Springer, Berlin, Heidelberg, 2005.
- [5] Sangiovanni-Vincentelli, Alberto Luigi, and Alessandro Pinto. “Embedded system education: a new paradigm for engineering schools?.” *ACM SIGBED Review* 2, no. 4 (2005): 5-14.
- [4] Balarin, Felice, Roberto Passerone, Alessandro Pinto, and Alberto L. Sangiovanni-Vincentelli. “A formal approach to system level design: Metamodels and unified design environments.” In *Proceedings of the 2nd ACM/IEEE International Conference on Formal Methods and Models for Co-Design*, pp. 155-163. IEEE Computer Society, 2005.
- [3] Sangiovanni-Vincentelli, Alberto L., and Alessandro Pinto. “An overview of embedded system design education at Berkeley.” *ACM Transactions on Embedded Computing Systems (TECS)* 4, no. 3 (2005): 472-499.
- [2] Pinto, Alessandro, Luca P. Carloni, and Alberto L. Sangiovanni-Vincentelli. “Efficient synthesis of networks on chip.” In *Proceedings 21st International Conference on Computer Design*, pp. 146-150. IEEE, 2003.
- [1] Pinto, Alessandro, Luca P. Carloni, and Alberto L. Sangiovanni-Vincentelli. “Constraint-driven communication synthesis.” In *Proceedings of the 39th annual Design Automation Conference*, pp. 783-788. ACM, 2002.

External Activities

Chair/Organizer:

- Workshop Co-Chair. “Design Automation for CPS and IoT (DESTION 2022)”, Co-located with IEEE/ACM CPS-IoT WEEK 2022. (<https://cps-vo.org/group/DESTION2022>)
- Program Co-Chair. “Design Automation for CPS and IoT (DESTION 2021)”, Co-located with IEEE/ACM CPS-IoT WEEK 2021. (<https://cps-vo.org/group/DESTION2021>)
- Organizer, “Accelerating AI for Embedded Autonomy” Workshop (<https://alessandro-pinto.github.io/aaiea2020/>), September 2020, Virtual.

- Organizer, “Accelerating AI for Embedded Autonomy” Workshop (<https://alessandro-pinto.github.io/aaiea2019/>), October 2019, New York, NY.
- Co-Chair, Numerical Software Verification Workshop, 2018
- PC-Co-Chair, Numerical Software Verification Workshop, 2018

Associate Editor, IEEE Transactions on Automation Science and Engineering, 2016-2019

Program Committee Member:

- 59th Design Automation Conference (DAC 2022), Autonomous Systems Track
- 27th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS 2021-2022)
- Design Automation and Test In Europe. Topic E3 “Machine Learning Solutions for Embedded and Cyber-Physical Systems” (DATE 2021-2022)
- 24th International Joint Conference on Artificial Intelligence (IJCAI) 2015
- International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2015-2022)
- AAAI 2014 Symposium, Modeling in Human-Machine Systems: Challenges for Formal Verification
- 24th International Joint Conference on Artificial Intelligence (IJCAI) 2015
- AAAI 2014 Symposium, Modeling in Human-Machine Systems: Challenges for Formal Verification
- IEEE International Symposium on Industrial Embedded Systems (SIES, 2010-2013)
- International Conference on Embedded Software (EMSOFT) 2010
- 47th Design Automation Conference 2010
- 46th Design Automation Conference 2009
- 5th Workshop on Synchronous Languages, Applications, and Programming (SLAP) 2006

Session Chair:

- Session Chair, Future of IC Reliability, 49th Design Automation Conference
- Tutorials Chair, Embedded Systems Week 2013
- Moderator: Performance and Power Issues in Embedded System-Level Design, International Conference on Computer-Aided Design, 2009

Talks and panels:

- “Model-Based Engineering”, Seminar, University of California, Santa Cruz, March 7, 2022
- “Model-Based Engineering: State-of-the-art, gaps, and needs”, Invited Lecture, U.C. Berkeley EE149/249
- “Design of Autonomous Systems: Engineering, Science, or Art?” Panel Speaker at the Design Automation Conference, 2020

- CISE Seminar, Boston University, “Planning Via Constrained Markov Decision Processes”
- Invited Talk at the Arizona State University. “Embedded AI”
- Workshop on Complex Collaborative Systems, “Knowledge-based Architectures” (invited talk), IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2017)
- Workshop on Verification and Control of Cyber-physical Systems: Theory and Applications, Invited Speaker, 55th Conference on Decision and Control
- Modeling Complex Industrial Systems (Panel), Organizer and Moderator, Embedded Systems Week 2013
- Model-Based Tool Chains for the Probabilistic Analysis of Complex Systems, Boston University, 2010
- Verification of Autonomous Systems, 31st Annual National Test & Evaluation Conference, 2016
- Model-Based Design of Uncertain Systems: Why and How, CCDC Seminar, University of California, Santa Barbara
- Code Generation Infrastructure for a Multi-Modal Synchronous MoC, Workshop on Software Synthesis, Embedded Systems Week 2013
- On the development of tools for system design, Institute for Systems Research, University of Maryland, 20
- Invited US industry representative, Trans-Atlantic Modeling and Simulation for Cyber-Physical Systems, Georgia Institute of Technology, 2015