

Philip Koopman, Ph.D.

Key Areas of Expertise:

- Autonomous system (robot) testing and safety, especially self-driving cars
- Automotive electronics and software safety for conventional vehicles
- Embedded systems: software engineering, hardware design, safety, security, testing
- Embedded safety-critical network protocols

Positions:

1996-...: Faculty, ECE Dept., Carnegie Mellon University; Associate Professor with Tenure 2002.
2014-2021: Co-Founder, Edge Case Research; autonomous vehicle & embedded software safety.
1991-1995: Principal Research Engineer, United Technologies Research Center; Embedded Systems.
1989-1990: Senior Scientist, Harris Semiconductor; CPU Design.
1984-1990: Startup Founder, WISC Technologies; CPU Design.
1983-1987: Officer, US Navy; Submarine Officer, Engineering Duty Officer; combat veteran status.

Education:

1989: PhD, Carnegie Mellon University, Computer Engineering
1982: BS & MS, Rensselaer Polytechnic University, Computer Engineering

Selected Publications:

- Koopman, P., "How Safe Is Safe Enough? Measuring and predicting autonomous vehicle safety," 2022. ISBN: 979-8848273397.
- Koopman, P., The UL 4600 Guidebook: What to Include in an Autonomous Vehicle Safety Case, November 2022. ISBN: 9798846251243.
- Koopman, P., "Tech Roadmap for Automakers Disillusioned With Robotaxis," Ojo-Yoshida Report, Oct 31, 2022.
- Johansson, R. & Koopman, P., "Continuous Learning Approach to Safety Engineering," Critical Automotive Applications: Robustness & Safety / CARS@EDCC2022.
- Widen, W. & Koopman, P., "Autonomous Vehicle Regulation and Trust: the impact of failures to comply with standards", UCLA Journal of Law and Technology, Vol. 27, No. 3, Spring 2022.
- Pezzementi, Z., et al. (including Koopman, P.) (2021). "Perception robustness testing at different levels of generality." Field Robotics, 1, 253–286.
- Koopman, P., Kuipers, B., Widen, W. & Wolf, M., "Ethics, Safety, and Autonomous Vehicles," IEEE Computer, Dec. 2021.
- Underwriters Laboratories, Standard for Evaluation of Autonomous Products, April 2020. (Principal Author). 2nd Edition March 2022.
- Koopman, P., "Self-Driving Cars: Sensors to Prediction," in: Yoshida, J., Editor, Aspencore Guide to Sensors in Automotive, 2020.
- Koopman, P., Ferrell, U., Fratrick, F. & Wagner, M., "A Safety Standard Approach for Fully Autonomous Vehicles," WAISE 2019, Sept. 2019.
- Koopman, P., Osyk, B. & Weast, J., "Autonomous Vehicles Meet the Physical World: RSS, Variability, Uncertainty, and Proving Safety," SAFECOMP, Sept. 2019.
- Koopman, P., Osyk, B., "Safety argument considerations for public road testing of autonomous vehicles," SAE WCX, April 2019.

- Koopman, P., Kane, A. & Black, J., "Credible Autonomy Safety Argumentation," Safety-Critical Systems Symposium, Bristol UK, Feb. 2019.
- Koopman, P. & Fratrick, F., "How many operational design domains, objects, and events?" SafeAI 2019, AAAI, Jan 27, 2019.
- Koopman, P., "Practical Experience Report: Automotive Safety Practices vs. Accepted Principles," Safecomp, Sept. 2018.
- Pezzementi, Z., Tabor, T., Yim, S., Chang, J., Drozd, B., Guttendorf, D., Wagner, M., & Koopman, P., "Putting image manipulations in context: robustness testing for safe perception," IEEE International Symposium on Safety, Security, and Rescue Robotics (SSRR), Aug. 2018.
- Koopman, P., "The Heavy Tail Safety Ceiling," Automated and Connected Vehicle Systems Testing Symposium, June 2018.
- Hutchison et al., "Robustness Testing of Autonomy Software," ICSE-SEIP, 2018.
- Koopman, P. & Wagner, M., "Toward a Framework for Highly Automated Vehicle Safety Validation," SAE World Congress, 2018. SAE-2018-01-1071
- Koopman, P. and Wagner, M., "Autonomous Vehicle Safety: an interdisciplinary challenge," IEEE Intelligent Transportation Systems Magazine, Vol. 9 #1, Spring 2017, pp. 90-96.
- Koopman, P. and Wagner, M., "Challenges in Autonomous Vehicle Testing and Validation," SAE Int. J. Trans. Safety 4(1):2016, doi:10.4271/2016-01-0128
- Kane, Chowdhury, Datta & Koopman, "A Case Study on Runtime Monitoring of an Autonomous Research Vehicle (ARV) System," RV 2015.
- Koopman, Driscoll, Hall, "Selection of Cyclic Redundancy Code and Checksum Algorithms to Ensure Critical Data Integrity," DOT/FAA/TC-14/49 , March 2015
- List of other publications: <http://users.ece.cmu.edu/~koopman/pubs.html>

Recent Teaching: (Course lecture slides: <https://users.ece.cmu.edu/~koopman/lectures/>)

- 18-348 Embedded System Engineering (undergraduate)
- 18-642 Embedded System Software Engineering (graduate)

Other:

- 2018 IEEE-SSIT Carl Barus Award for Outstanding Service in the Public Interest.
- 2019 AutoSens Inspiration Award.
- Member US National Safety Council Mobility Advisory Group.
- Research funding from US Army, General Motors, Volkswagen, FAA, John Deere Co., Bosch, DaimlerChrysler, Bombardier, ABB, and NASA.
- Service on Program Committees for numerous international conferences and workshops, including SAFECOMP and DSN. Program Chair of DSN 2012. General Chair of DSN 2008.
- Peer review services for National Research Council, National Science Foundation, Proceedings of the IEEE, ACM Computing Surveys, numerous IEEE Transactions, workshops, etc.
- Keynote talks at international conferences and workshops including: ICSE, SEAMS, SCAV, ISSRE, SAFECOMP, SSIV, WAISE, SCC, SCSC, US DOT Events, NSF Workshops.
- Invited talks include: UC Berkeley, Johns Hopkins APL, Georgia Tech., Chalmers, LAAS/CNRS, KTH, Sun Yat-Sen University, FAA, NTSB, US DOT, NRC, automotive companies.
- Named inventor on 27 issued US patents.
- Active in autonomous vehicle policy, regulation, and standards. (PA, US, International.)
- Navy expeditionary medal, Navy achievement medal, Submarine Warfare Officer (gold dolphins).
- Senior Member IEEE; Senior Member ACM; Member SAE; Member IFIP WG 10.4.