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Engineering & Scientific Consulting

Nithin Raghunathan, Ph.D.

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Professional Profile

Dr. Raghunathan specializes in electrical and electronics engineering. He uses his knowledge and background in electrical systems and sensors to assist clients in a variety of projects.

Dr. Raghunathan's work often includes design reviews and engineering analyses of electrical systems. He has experience with code and standard reviews, IoT networks, RF systems, embedded systems, electrical design analysis, printed circuit board (PCB) design analysis, IP matters, and fire investigations. Dr. Raghunathan's projects have involved investigations related to industrial accidents, PCB and control system failures. He has significant experience in the field of aviation and aviation systems. Dr. Raghunathan is a FAA certified commercial pilot, flight instructor, and sUAS drone operator.

Dr. Raghunathan has over a decade of experience in the design of electronic circuits, printed circuit boards (PCBs), embedded, (particularly for industrial applications) and wireless systems. He has significant experience in micro/nano fabrication techniques in cleanroom environments and printed circuit board assembly (PCBA) techniques. He has worked with a wide variety of design tools including Altium, Eagle, and Cadence for schematic design and PCB layout, L-Edit for lithography layouts, finite element analysis (FEA) tools such as COMSOL and Coventor, C/Python for embedded system development and MATLAB, ORIGIN Pro and Tecplot for data analysis. He has extensive knowledge of electrical and semiconductor characterization tools, such as scanning electron microscopes, semiconductor characterization systems and network analyzers.

Prior to joining Exponent, Dr. Raghunathan worked as a staff scientist for the Birck Nanotechnology Center at Purdue University, where he was involved in the development of IoT wireless sensors and sensor networks for various Industrial and Agricultural applications. His work in this role involved the development of wireless and flexible sensors, sensors for Lyophilization and aseptic processing, and wireless sensors for concrete curing. He received his Ph.D. in Electrical engineering from Purdue University in 2014 where his dissertation focused on the development of MEMS g-switches for impact applications. He also worked as a Post-Doctoral Research associate after graduation and was involved in the development of wireless radiation sensors for dosimetry applications. In addition, Dr. Raghunathan has significant teaching experience, both in the classroom and as a certified flight instructor.

Academic Credentials & Professional Honors

Ph.D., Electrical And Computer Engineering, Purdue University, 2014

B.S., Electrical Engineering, Purdue University, 2007

Eta Kappa Nu Honor Society

Licenses and Certifications

Certified Flight Instructor in single and multiengine airplanes and instruments

Certified Flight Instructor Instruments (CFII)

Commercial Airplane, Instrument, Multi-engine pilot

Commercial drone operator

First Aid, CPR, and AED trained

Prior Experience

Research Scientist, Birck Nanotechnology Center, Purdue University, 2015-2022

Post-Doctoral Research Associate, Purdue University, 2014-2015

Professional Affiliations

Institute of Electrical and Electronic Engineers ─ IEEE (member)

Society of Aviation and Flight Educator ─ SAFE (member)

National Association of Flight Instructors ─ NAFI (member)

Aircraft Owners and Pilots Association ─ AOPA (member)

Experimental Aircraft Association ─ EAA (member)

Patents

Patent 10,641,661 B2: Process control using non-invasive printed product sensors May 2020 (with Ganguly.A, Renzi E, Demarco FW, Peroulis D).

Patent Application 16/518,970: Wireless sensors, systems, and methods thereof, March 2016 (with Peroulis D, Hall MT).

Patent Application 14/972,494: Multi-Axis Levitating Vibration Energy Harvester. December 2015 (with Peroulis D, Scott SM, Berdy DF).

Patent Application 14/870,267: Electronic System for Measurement of Radiation-Sensitive MOS Devices (with Scott SM, Peroulis D, Rajabather H, Walerow PA, Valentino DJ).

Publications

Lee W.J, Wu H, Raghunathan N, Sutherland and M. Jun The Environmental Impact of Life Extension for Different Products and Evaluating the Effectiveness of Predictive Maintenance on Product Life. CIRP Annals (Submitted)

Gopalakrishnan S, Waimin J, Raghunathan N, Bagchi S, Shakouri A and Rahimi R, "Battery-less wireless chipless sensor tag for subsoil moisture monitoring," in IEEE Sensors Journal vol. 21, no. 5, pp. 6071-6082, 1 March1, 2021

Patel K., Massa K., Raghunathan N., Zhang H., Iyer A., & Bagchi, S. (2020, November). Proactive

privacy-preserving proximity prevention through bluetooth transceivers. In Proceedings of the 18th Conference on Embedded Networked Sensor Systems (pp. 778-779).

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Chatterjee B, Seo DH, Chakraborty S, Avlani S, Jiang X, Zhang H, Abdallah M, Raghunathan N, Mousoulis C, Shakouri A,. and Bagchi S, Context-Aware Collaborative Intelligence with Spatio-Temporal In-Sensor-Analytics for Efficient Communication in a Large-Area IoT Testbed. in IEEE Internet of Things Journal, vol. 8, no. 8, pp. 6800-6814, 15 April, 2021.

Jiang X., Zhang H., Yi EAB., Raghunathan N., Mousoulis C., Chaterji S., Peroulis D., Shakouri A. and Bagchi S, Hybrid Low-Power Wide-Area Mesh Network for IoT Applications, in IEEE Internet of Things Journal, doi: 10.1109/JIOT.2020.3009228.

Jiang X, Tong Z, Kodama T, Raghunathan N, Peroulis D and Aleexenko, A Multi-Point Wireless Temperature Sensing System for Monitoring Pharmaceutical Lyophilization, Frontiers in Chemistry ,vol 6, pp288, 2018.

Raghunathan N, Tsuitsui W, Chen W, and Peroulis D. Acceleration detection Algorithm for Novel MEMS g-switch. Journal of Micromechanics and Microengineering, (Submitted).

Parkos D, Raghunathan N, Venkattraman A, Sanborn B, Chen W, Peroulis D, and Alexeenko A, Near-Contact Gas Damping and Dynamic Response of High-g MEMS Accelerometer Beams, in Microelectromechanical Systems, Journal of, vol.22, no.5, pp.1089-1099, Oct. 2013

Dubelman S, Raghunathan N, Peroulis D, Chen W Failure Analysis of Micron Scaled Silicon Under High Rate Tensile Loading Dynamic Behavior of Materials, Volume 1, 157-158 2014.

Tsutsui W, Raghunathan N, Chen W, Peroulis D Testing Techniques for Shock Accelerometers below 10,000 g, Dynamic Behavior of Materials, Volume 1, 2014.

Dubelman S, Raghunathan N, Peroulis D, Chen W The Development of a High Rate Tensile Testing System for Micro Scaled Single Crystal Silicon Specimens. Experimental Mechanics, 2013.

Wang MF, Raghunathan N, Ziaie B, A Nonlithographic Top-Down Electrochemical Approach for Creating Hierarchical (Micro−Nano) Superhydrophobic Silicon Surfaces. Langmuir 2007, 23(5) , 2300-2303.

Conference Papers

Jiang H, Yu W, Waimin JF, Glassmaker N, Raghunathan N, Jiang X, Ziaie B and Rahimi R. Inkjet-Printed Solid-State Potentiometric Nitrate Ion Selective Electrodes for Agricultural Application, Nov 2019 IEEE SENSORS, Montreal, 2019.

Jiang X, Waimin JF, Jiang X, Mousoulis C, Raghunathan N, Rahimi R and Peroulis D, Wireless Sensor Network Utilizing Flexible Nitrate Sensors for Smart Farming. 2019 IEEE SENSORS, Montreal, 2019.

Mousoulis C, Jiang X, Raghunathan N and Peroulis D, A hybrid, networked, wireless system for humidity sensing, 2017 IEEE SENSORS, Glasgow, 2017, pp. 1-3.

Raghunathan N, Jiang X, Ganguly A and Peroulis D, An ANT-based low-power battery-free wireless cryogenic temperature probes for industrial process monitoring, 2016 IEEE SENSORS, Orlando, FL, 2016, pp. 1-3.

Raghunathan N, Jiang X, Ganguly A and Peroulis D, An ANT-based low-power battery-free wireless cryogenic temperature probes for industrial process monitoring, 2016 IEEE SENSORS, Orlando, FL, 2016, pp. 1-3.

Raghunathan N, Jiang X, Peroulis D and Ganguly A, Wireless low-power temperature probes for food/pharmaceutical process monitoring, 2015 IEEE SENSORS, Busan, 2015, pp. 1-4.

Scott S, Mousoulis C, Raghunathan N, Peroulis D; Valentino DJ, Walerow PA, Salasky M, and Rajabather H, MOS-capacitor-based ionizing radiation sensors for occupational dosimetry applications, 2015 IEEE SENSORS, Busan, 2015, pp. 1-4.

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Raghunathan N, Tsutsui W, Chen W and Peroulis D, A single crystal silicon low-g switch tolerant to impact accelerations up to 24,000 g, In 18th International Conference on Solid-State Sensors, Actuators and Microsystems (TRANSDUCERS), Anchorage, AK, 2015, pp. 1144-1147.

Raghunathan N, Sanborn B, Venkattraman A, Alexeenko A, Chen W, Peroulis D, Real-time in situ electronic monitoring of dynamic contact behavior of MEMS high-g switches,, 2012 IEEE 25th International Conference on Micro Electro Mechanical Systems (MEMS), Jan. 29 2012.

Parkos D, Raghunathan N, Ayyasamy V, Aleexenko A, and Peroulis D. Near Contact Damping Model and Dynamic response of μ-beams under High-g loads. In 2011 IEEE MEMS, Jan. 2011.

Raghunathan N, Nishida E, Fruehling A, Chen W, and Peroulis D. Arrays of silicon cantilevers for detecting high-g rapidly varying acceleration profiles. In IEEE Sensors, Nov. 2010.

Wang MF, Raghunathan N, Ziaie B, A Nonlithographic Approach for Creating Unstable Hierarchical (Micro-nano) Superhydrophobic Silicon Surfaces, Accepted at ASME International Mechanical Engineering Congress & Exposition, Chicago, IL, November 2006.

Books

Peroulis D, Raghunathan N, Robinson B and Swabey M. First Designs in Electrical Engineering, IA: Kendall Hunt Publishing company, 2015.

Peroulis D, Raghunathan N, and Robinson B. Electrical Engineering: Hands-on Learning, IA: Kendall Hunt Publishing company, 2012.

Presentations

Nithin Raghunathan, Charilaos Mousoulis, IoT Networks: Sensors and Data Visualization, Spring Digital Agriculture Webinar Series, Purdue University, April 29, 2021.

Nithin Raghunathan, Microfabrication, Characterization and Sensor Development in the Industrial Space, https://nanohub.org/resources/29161 (2018).

Raghunathan N, Low-power Battery-free Wireless Sensors for Industrial Process Monitoring. Peck Symposium on Pharmaceutical Manufacturing, March 2018, Lafayette, IN.

Raghunathan N, Advanced Aseptic Process Monitoring, Aseptic Processing & Sterilization in Pharma , Dec 2017 , Boston, MA.

Raghunathan N, Ganguly A, The new equation for pharmaceutical lyophilisation.(Live Webinar).