

Santosh M Rajkumar

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EDUCATION

The Ohio State University

Columbus, OH

Ph.D. in Mechanical Engineering; GPA: 4.0/4.0

Aug 2023 – Present

Focusing on data-driven estimation and control for nonlinear systems using Koopman Theory

Courses: Optimal Control, Nonlinear Dynamics, Nonlinear Systems, Adv. Mathematical methods

Miami University

Oxford, OH

Master of Science in Mechanical Engineering; GPA: 4.0/4.0

Jan 2021 – Jun 2023

Thesis: *Haptic Rendering in Touch Surfaces Using Multifrequency Electrostatic Actuation*

Courses: Adv. Mechanics of Materials, Finite Element Analysis, Control of Dynamic Systems, Applied Nonlinear Dynamics, Robotics: Design & Modeling, Intro to AI, Engineering Analysis, Advanced Data Visualization

National Institute of Technology Silchar

Silchar, India

Bachelor of Technology in Electrical Engineering; GPA

Aug 2013 – May 2017

Thesis: *Online time-delay estimation & adaptive compensation in an wireless NCS*

EXPERIENCE

SOAR Lab, The Ohio State University

Columbus, OH

Graduate Research Associate

Aug 2023 – Present, Part-time

- Working on learning bilinear models of non-linear systems from partial-state measurement data and prediction using the learned models.
- Working on the development of Koopman linear models of spacecraft dynamics in $SO(3)/SE(3)$ and optimal control methods based on the Koopman linear models.

Singh Research Group, Miami University

Oxford, Ohio

Graduate Research Assistant

Aug 2021 – May 2023, Part-time

- Developed finite element modeling methods of bar-type and rectangular touch displays with electrostatic vibration actuators providing spring-damper boundaries. Developed in-house MATLAB FE code that can accommodate multi-frequency excitation.
- Developed a computationally efficient solution method for dynamic simulation of FE models of the touch displays with harmonic excitation.
- Demonstrated the possibility of positioning haptic feedback on a large touch surface by varying excitation frequencies of electrostatic vibrations actuators both in simulation & experiment.
- Fabricated prototype of a bar-type and rectangular touch display interfaces with multiple electrostatic vibration actuators for experimental validation of the proposed method.
- Used statistical and advanced visualization methods in R for the strategic placement of actuators for effective haptic rendering and optimization of actuator mechanical properties.
- Performed experimental modal analysis of hammer vibration test data of 3D printed structures to obtain modal information.
- Performed density-based clustering of modal analysis data of human bone vibration data to determine bone health based on higher modes of damping.

Indian Oil Corporation Limited

Dimapur, India

Senior Engineer

Jun 2017 – Dec 2020, Full-time

- Performed periodic & preventive maintenance activities for a large petroleum installation's safety automation and electrical systems.
- Performed vibration-based monitoring of machinery and vision-based robotic inspection of petroleum storage facilities.
- Developed web applications for critical information storage using JS, Python, and AWS.
- Handled tendering & negotiations with vendors for purchases. Managed purchases and acquisitions in SAP.
- Handled training & development of a large industrial workforce to ensure safe and standard operating conditions.

SKILLS

Programming & Simulation: MATLAB, Python, R, JavaScript, Simulink, LabView

Libraries & Tools: PyTorch, OpenCV, pandas, tidyverse, ggplot2, R Shiny, HTML, CSS3

CAD & Analysis: Fusion 360, COMSOL

Prototyping, fabrication, & testing: Milling, lathe, welding, Dremel 3D Printer, Universal Testing Machine

Others: ROS, Arduino, Linux, Git, NI-cDAQ, Latex, MS Excel

PUBLICATIONS

Rajkumar, S.M., Singh, K. V., Koo, J. H., and Yang, T. H. (2023, August). Modeling and Analysis of a Thin Plate With Multiple Harmonic Excitations for Vibrotactile Touch Display Applications. In International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (Vol. 87400, p. V012T12A018). American Society of Mechanical Engineers.

Rajkumar, S.M., Singh, K.V., Yang, T.H. and Koo, J.H., "Modeling and Experimental Evaluation of Haptic Localization Using Electrostatic Vibration Actuators," in IEEE Access, vol. 11, pp. 18582-18589, 2023.

Rajkumar, S.M., Singh, K.V. and Koo, J.H., 2022, October. Modeling and Analysis of Multiple Electrostatic Actuators on the Response of Vibrotactile Haptic Device. In ASME International Mechanical Engineering Congress and Exposition (Vol. 86625, p. V001T01A004). American Society of Mechanical Engineers.

Rajkumar, S.M., Chakraborty, S., Dey, R. and Deb, D., 2020. Online delay estimation and adaptive compensation in wireless networked system: an embedded control design. International Journal of Control, Automation and Systems, 18, pp.856-866.

TEACHING EXPERIENCE

Department of Mechanical & Manufacturing Engineering, Miami University

Oxford, OH

Graduate Teaching Assistant

Jan 2021 - May 2023

- System Modeling, Analysis, & Control (MME 321) Spring 2023
 - Graded homework, lab reports, and lab projects. Held office hours. Conducted simulation-based lab sessions. Prepared MATLAB & Simulink-based lab experiments.
- Mechanical Vibrations (MME 315) Winter 2023, Summer 2021, Spring 2021
 - Graded homework, computational assignments, and projects. Held office hours.
- Control of Dynamic Systems (MME 436/536) Fall 2022, Spring 2022, Winter 2022, Fall 2021
 - Conducted lab experiments based on the interfacing of Labview with dynamical systems and MATLAB-based simulations. Graded lab reports and lab quizzes.
- Mechanical Workshop (MME Lab) Fall 2022, Spring 2022, Fall 2021
 - Assisted students from manufacturing methods courses and senior design in conventional machining and 3D printing. Performed periodic maintenance of machinery in the lab.
- Manufacturing Automation (MME 437) Spring 2021
 - Assisted the instructor in conducting lab sessions. Graded lab reports and assignments.

TECHNICAL PRESENTATIONS / CONFERENCES / INVITED TALKS

ASME IDETC CIE 2023, Boston, MA : Presented the research titled *Modeling and Analysis of a Thin Plate with Multiple Harmonic Excitations for Vibrotactile Touch Display Applications*. (Aug 2023)

ASME IMECE 2022, Columbus, Ohio: Presented the research titled *Modeling and Analysis of Multiple Electrostatic Actuators on the Response of Vibrotactile Haptic Device*. (Nov 2022)

Graduate Research Forum 2022, Miami University, Oxford, Ohio: Presented the research titled *Modeling of large touch surfaces with electrostatic actuators for localized haptic feedback* (Nov 2022)

Invited talk, NIT Silchar, India (virtual) : Delivered a virtual invited lecture on *Linear Control System Application Areas & Modeling of Mechanical Systems* for junior undergraduate students. (Sep 2022)

MENTORSHIP

Nikita Shubin: Undergraduate Mechanical Engineering Student at Miami University (Spring 2023)

Jake Zickerman: Undergraduate Mechanical Engineering Student at Miami University (Spring 2023)

Charlie Clark: Undergraduate Mechanical Engineering Student at Miami University (Spring 2023)

Neil Jain: Undergraduate Mechanical Engineering Student at Miami University (Spring 2023)

Tung Ho: Undergraduate Mechanical Engineering Student at Miami University (Spring 2023)

Becca Wolfe: Undergraduate Mechanical Engineering Student at Miami University (Spring 2023)

AWARDS & ACHIVEMENTS

Summer Research Fellowship: Funding for conducting summer research from Miami University. (2022,2023)

GSSA Award : Awarded with a full tuition waiver and teaching assistantship from Miami University (2021-2023)