Sambad Regmi

Curriculum Vitae   ↪ *Personal Web Page*

▬ Education

May 2022	**Ph.D, Mechanical Engineering**, *Missouri University of Science and Technology*, Rolla, MO, (GPA: 3.933).
	Dissertation Title: "Development of an Interactive Robot for Overground Physical Human-Robot Interaction"
	Advisor: Dr. Yun Seong Song
Jun 2016	**B.E, Mechanical Engineering**, *Visvesvaraya Technological University*, Bangalore, India, (85%).

▬ Professional Experience

May 2022 – Present

Senior Mechatronics Engineer, *ASML*, Wilton - CT.

- Working with system architects in a multi-discipline project team to develop concepts, build mechatronics prototypes and test modules of Advanced Semiconductor Lithography Machines.
- Create budgets and set mechatronics requirements of the hardware components/modules
- Act as a technical leader and contribute to breakdown of complex technical problems, analyze the problems from different angles and find multiple solutions to choose from.
- Perform engineering analysis and facilitate development of mechatronics modules. This include kinematics and dynamics analysis, controller design, performance analysis, data analysis, working with real-time system, motors, motor drives, sensors etc.
- Understand team goal, provide deliverable on time and take responsibility for decisions.
- Define, plan and priorities tasks and follow-up on results.
- Communicate clear to technical team (and broad audience), about directions and expectations and follow up and feedback on results.

Aug 2017 – Apr 2022

Graduate Research Assistant, *Missouri University of Sci. and Tech.*, Rolla, MO.

- Single-handedly designed and developed an one of a kind robot capable of physically interacting with humans in an overground setting (patent filed and published, currently under review). The work included mechanical design, mechatronics/electrical architecture conceptualization and implementation, controller design and implementation, system kinematics and dynamic study, test and analyze robot performance etc. This robot acted as a tool that helped our research team to conduct pioneering physical human-robot interaction studies.
- Performed a through kinematics and dynamics analysis of the above-mentioned robot's manipulator. Not only this led to development of a simulator for dynamics analysis of the robotic manipulator but also published a detailed steps on how this can be done in future (publication no 2 below). This work also covered (1) estimation the friction/damping of rotational joints, and verification of its accuracy using the effective inertia estimate and (2) a method to estimate the output impedance of a manipulator using the robotic simulator
- Designed data acquisition and analysis technique for overground physical human-robot interaction experiments
- Designed and conducted the the human-robot interaction experiment, including acquiring an IRB approval, recruiting and interacting with the participants, preparing and maintaining the experiment setup, collecting and analyzing the data, and reporting results
- Published high impact journal articles and conference proceedings; Presented research findings as posters and conference presentations

Sep 2021 – Dec 2021   **Engineering Intern, (Mechatronics)**, *ASML*, Wilton - CT.

- Worked on sub-systems involving robotics, mechatronics, and precision mechanics, which involved understanding the functional requirements and deriving specifications
- Developed a tool that is currently being used to study dynamic stability behavior of one of the module of High-NA EUV Lithography Machine (new generation semiconductor lithography machine)

Publications

[1] **Regmi, S.**, Song, Y. S., "Design methodology for robotic manipulator for overground physical human-robot interaction", *ASME Journal of Mechanisms and Robotics*, **12**(4), p. 041002, 2020.

[2] **Regmi, S.**, Song, Y. S., "Estimation of Endpoint Impedance of a 2D Parallel Manipulator using Numerical Simulation Experiment", *ASME International Mechanical Engineering Congress and Exposition,* **Vol. 84522**, American Society of Mechanical Engineers, 2020.

[3] **Regmi, S.**, Burns, D., and Song, Y. S., "A Robot for Overground Physical Human-Robot Interaction Experiments", *PLoS ONE,* **Vol. 17**(11), p. e0276980, 2022.

[4] **Regmi, S.**, Burns, D., and Song, Y. S., "Humans modulate arm stiffness to facilitate motor communication during overground physical human-robot interaction", *Scientific Reports, **Vol. 12***, p. 18767, Nature, 2022.

[5] **Regmi, S.** "Development of an Interactive Robot for Overground Physical Human-Robot Interaction", *Missouri University of Science and Technology*, PhD dissertation (Advisory committee reviewed, not peer reviewed)

[6] Kamma, T. K., **Regmi, S.**, Burns, D., and Song, Y. S., "Validation of the Human Arm Stiffness Estimation Method Developed for Overground Physical Interaction Experiments" *45th IEEE Engineering in Medicine and Biology Conference, Sydney, Australia.*, IEEE, 2023.

[7] Alluri, S. R., **Regmi, S.**, Rashid, F., Burns, D., and Song, Y. S., "Balance Assistance Without Mechanical Support Using a Virtual Cane", *Gait and Posture* (submitted, preprint available)

[8] Mohammadi Beirami, M., **Regmi, S.**, Burns, D., and Song, Y. S., "Exploring Kinematics Contribution to the Arm Stiffness Modulation During Overground Physical Human-Robot Interaction" *46th IEEE Engineering in Medicine and Biology Conference, Orlando, Florida, USA*, IEEE, 2024 *(accepted)*.

[9] Mohammadi Beirami, M., **Regmi, S.**, Rashid, F., Burns, D., and Song, Y. S., "Uncovering Human Arm Stiffness Modulation during Unpredictable Overground Physical Human-Robot Interaction Task through Kinematics Analysis", *not submitted, in preparation*

Conference Abstract/Presentation

[1] Presented a poster "Design Methods for Robots for Overground Physical Interaction" at 41st IEEE Engineering in Medicine and Biology Conference (EMBC 2019), Berlin, Germany.

[2] Presented research presentation "Estimation of Endpoint Impedance of a 2D Parallel Manipulator Using Numerical Simulation Experiments" at IMECE 2020 International Mechanical Engineering Congress and Exposition.

Other Presentations

[1] Presented a poster "Overground Physical Human-Robot Interaction" at 2021 IEEE STL Student Presentations Competitions, St. Louis, Missouri.

[2] Presented a poster "Humans Modulate Arm Stiffness to Promote Motor Communication during Robot Guided Walking" at Missouri University of Science and Technology Council of Graduate Student 3 Minutes Poster Competition, Rolla, Missouri. (won 5th place)

Patent

Sep 2023   **Regmi, S.** and Song, Y. S., "Mobile robot configured to determine human arm stiffness during overground interaction", *US Patent App. 17/939,698, pending (paper published)*.

Awards

Mar 2022   **3MT, Missouri S&T**, *Received the people's choice award.*

Dec 2021   **3 Minutes Poster Presentation, Missouri S&T Council of Graduate Students**, *Presented a summary of my PhD research, and grabbed 5th place for the best presentation .*

Nov 2020–   **John W. Claypool Fund for Medical Research**, *Received student research funding to advance*
Apr 2021   *research on human-human and human-robot interaction at Missouri S&T.*

Jul 2012–   **COMPEX Scholarship Scheme 2012, Embassy of India**, *Got selected through an open*
May 2016   *competition to pursue BE (Mech.) in India (Full Tuition Wavier and Monthly stipend).*

Teaching and Mentoring Experience

Jan 2020 –   **Graduate Teaching Assistant**, *Missouri University of Sci. and Tech., Rolla, MO.*
May 2021
- Taught Control System Laboratory for undergraduate seniors. The course covered basics of control systems including hardware implementation of control concepts and hands experience of control applications using PLC/LabVIEW software
- Evaluated students' semester performance based on individual performance during lab sessions, final exam, and project presentation
- Maintained regularly scheduled office hours to advise and assist students
- Taught a laboratory-heavy class online during Covid-19 situation using different strategies (whichever is feasible) such as remotely accessing the hardware, using simulated environments, and making video demos
- Experience with course management software like Canvas, and online teaching via Zoom

Journal/Conference Paper Reviews

[1] Woolfrey, J., Ajoudani, A., Lu, W., and Natale, L. "Optimal Configuration for Stiffness and Compliance in Human and Robot Arms", *PloS One*, Impact Factor (2022): 3.7 , ISSN: 1932-6203

[2] Schlafly M., Prabhakar, A., Popovic, K., Schlafly, G., Kim, C., and Murphey, T.D. "Collaborative Robots Can Augment Human Cognition in Regret-Sensitive Tasks", *Nature Scientific reports*, Impact Factor (2022): 4.6 , ISSN: 2045-2322

[3] Goell, F., Braunstein, B., Heieis, J., Braun, D., Reibner, R., Safronov, K., Weiglein, C., Schuengel, V. and Albracht, K. "Human–Robot Co–Manipulation: A Biomechanical Analysis of a Joint Carrying Task", *IEEE Transactions on Neural Systems and Rehabilitation Engineering* , Impact Factor (2022): 4.9 , ISSN: 1558-0210

[5] Zheng, Y., Yang, Y., Lin, C., Guang, C. Zong, J. and Ma, K. "Preliminary Estimation of the Friction between Force-sensing Forceps and Cornea", *2022 9th IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)* August 21-24, 2022 , Seoul National University, Seoul, Korea. ISSN: 2155-1782

[4] Anonymous "Advancements in Concepts of Smart Interfaces Between Human and Consumer Appliances", *IEEE 2023 International Conference on Data Science and Advanced Analytics (DSAA)*, conference proceeding, ISSN:2472-1573

[6] Anonymous "Automatic Annotation of Datasets for Autonomous Vehicles in Smart Cities", *IEEE 2023 International Conference on Data Science and Advanced Analytics (DSAA)*, conference proceeding, ISSN:2472-1573

[7] Anonymous "Application of Queueing Systems to Jobs Scheduling Problem", *IEEE 2023 International Conference on Data Science and Advanced Analytics (DSAA)*, conference proceeding, ISSN:2472-1573

Courses and Training

Coursework Advanced Topics in Decision and Control, Mechanical and Aerospace Control System, Introduction to Neural Networks, Discrete Neural Network Control, Control of Mobile Robots, Vibration, Advanced Vibrations, Autonomous Mobile Robots, Compliant Mechanism Design, Mechanics of Machinery, Machine Learning, Statistical Data Analysis, etc.

Trainings
- Mechatronics System Design - part 1 and part 2
- Dynamics Architecture
- Servo Control
- Servo Dynamics
- Stateflow for Logic-Driven Modeling
- Matlab Data Processing and Visualization

Skills

Dev Tools MATLAB, Simulink, StateFlow, LabVIEW, Python, SOLIDWORKS, PLC, Mathcad, C (basics)

Software Vicon Nexus, Kollmorgen Workbench, Microsoft Office, Latex, proCalc, JMP, SAS, SQLite

Hardware Experience Speedgoat Real-Time Target and associated control systems; DirectSoft PLC; LabVIEW Real-Time and associated control systems; LabVIEW SoftMotion, LabVIEW FPGA, and other Modules; Motion capture system (Vicon Motion Systems); Brushless DC motors (AKD, Anahiem Automations (AA) and others); Motor drives and contollers (AKD and AA); ATI Force/Torque sensor, and controller; Data acquisition systems (RS232, NI USB6021, NI cRIO 9045 modules, and AA modules); custom hardware (Linear motors, acquisition system, etc.)

Language English (proficient), Hindi (proficient), Nepali (native fluency)