

CHAWIN OPHASWONGSE

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Department of Mechanical Engineering
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CURRENT POSITION

Robotics And Rehabilitation Laboratory (RoAR Lab), Columbia University

Postdoctoral Fellow | Advisor: Sunil K. Agrawal, Ph.D.

New York, NY
Oct. 2021 - Present

EDUCATION

Columbia University

Doctor of Philosophy (Ph.D.) in Mechanical Engineering (GPA 4.00/4.00)
Dissertation: "Design of Wheelchair Robot for Active Postural Support (WRAPS) for Users with Trunk Impairment"
Master of Science (M.S.) in Mechanical Engineering: Robotics and Control (GPA 4.11/4.00)

New York, NY
Jan. 2018 - Oct. 2021

Aug. 2016 - Dec. 2017

Chulalongkorn University

Bachelor of Engineering (B.E.) in Mechanical Engineering (GPA 3.90/4.00, 1st Class Honors)

Bangkok, Thailand
May 2011 - Jul. 2015

GRANTS AND AWARDS

Individual Postdoctoral Fellowship in Spinal Cord Injury Research

New York State Spinal Cord Injury Research Board (SCIRB), New York State Department of Health

2023 - 2025

Innovative, Developmental, or Exploratory Activities (IDEA) Grant in Spinal Cord Injury

New York State Spinal Cord Injury Research Board (SCIRB), New York State Department of Health

2021 - 2023

Anandamahidol Foundation Scholarship under the Patronage of His Majesty the King of Thailand

Unconditional full-ride scholarship for graduate studies, one of just two awarded nationwide in the field of engineering

2015 - 2021

Academic Excellence in Graduate Studies, M.S. in Mechanical Engineering Class of 2018

Among the top 10% of students with the highest GPAs from a total of ~ 70 students, Columbia University, NY

2018

Gold Medal Award for achieving the highest GPA in the Mechanical Engineering Department (~100 students)

Chulalongkorn University, Bangkok, Thailand

2015

Outstanding Senior Project Award: 2nd Place Senior Project out of 41 Projects in the Academic Year 2014

Department of Mechanical Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok, Thailand

2015

Dean's List throughout undergraduate studies

Faculty of Engineering, Chulalongkorn University, Bangkok, Thailand

2011 - 2014

EXPERIENCE

Robotics And Rehabilitation Laboratory (RoAR Lab), Columbia University

Postdoctoral Fellow | Advisor: Sunil K. Agrawal, Ph.D.
Graduate Research Student

New York, NY
Oct. 2021 - Present
Jul. 2016 - Oct. 2021

Wheelchair Robot for Active Postural Support (WRAPS) for users with trunk impairments

- Invented robotic torso exoskeletons to assist seated movements for individuals with cervical or thoracic spinal cord injury (SCI)
- Formulated novel optimization frameworks for generating robotic mechanisms from motion capture data of trunk movements
- Led human subject studies to validate efficacy of robotic prototypes and explore their application in neuromotor rehabilitation training

Regional Center of Robotics Technologies, Chulalongkorn University

Research Assistant | Advisor: Viboon Sangveraphunsiri, Ph.D.
Upper-limb Rehabilitation Robot for Stroke Patients

Bangkok, Thailand
Aug. 2015 - Jun. 2016

- Designed and built a 2-DOF planar five-bar mechanism robot used for stroke rehabilitation at King Chulalongkorn Memorial Hospital
- Led mechanical design to achieve a structure withstanding 20 kg load at the end-effector with sub-millimeter deflection
- Developed a real-time GUI and force/trajectory controllers in Microsoft Visual Studio (C++) interfacing with a Sensoray 626 PCI data acquisition board and two AC servo motors

Center of Excellence for Prosthetic and Orthopedic Implant, Chulalongkorn University

Research Assistant | Advisor: Pairat Tangpornprasert, Ph.D.

Bangkok, Thailand
Jun. 2014 - Jul. 2015

Senior Capstone Research Project: "Design of a Hydraulic Knee Prosthesis Using a Valve Controlling Mechanism"

- Designed an affordable mobile hydraulic system for a passive knee prosthesis, facilitating flexion locking during the stance phase and damping control throughout the swing phase of gait
- Performed physics simulations in MATLAB Simulink to integrate a hydraulic system to a passive knee mechanism, optimizing the sizing of both off-the-shelf hydraulic components and a custom-made hydraulic cylinder
- Expanded the research into a peer-reviewed journal publication following graduation

Triumph Aviation Services - Asia, Ltd. (TASA)

Mechanical Engineering Intern, Reverse Engineering Team, Repair Product Line

Chonburi, Thailand
Mar. 2014 - May 2014

- Established a 3D model database of mechanical components in Auxiliary Power Units (APUs) using a FARO 3D scanner and reverse engineering software (Polyworks Inspector, Geomagic Design X), adhering to FAA regulations for maintenance purposes
- Developed a 3D SolidWorks model of an APU shipping stand for in-house handling and transportation

INVITED TALKS AND PRESENTATIONS

Columbia University Postdoctoral Research Symposium “Training Seated Postural Coordination in a Virtual Reality Reaching Game by Active Pelvic Guidance from a Robotic Exoskeleton”, Poster presentation delivered at Columbia University Irving Medical Center	May. 3 rd 2024 New York, NY
Robotics and Human Health: Assessment and Rehabilitation Workshop “Design and Kinematic Validation of a Robotic Exoskeleton for Assisting Seated Pelvic Movements by Wheelchair Users with Trunk Impairments”, Oral presentation delivered online at the University of Sousse	Jun. 2 nd 2023 Sousse, Tunisia
Tikkun Olam Makers (TOM) Talks: Medical Design “Wheelchair Robot for Active Postural Support (WRAPS) for Users with Impairment of the Trunk” Oral presentation delivered online as collaboration between Pratt Institute and Columbia University	Mar. 15 th , 2021 New York, NY
IEEE International Conference on Robotics and Automation (ICRA), 2020 “Optimal Design of a Novel 3-DOF Orientational Parallel Mechanism for Pelvic Assistance on a Wheelchair” Oral presentation delivered online at the fully virtual conference	Jun. 3 rd , 2020 Paris, France
NYS Spinal Cord Injury Research Symposium 2018 “Wheelchair Robot for Active Postural Support (WRAPS) for SCI Patients” Poster presentation delivered at The Rockefeller University	Oct. 16 th , 2018 New York, NY
ASME 41st Mechanisms and Robotics Conference, 2017 “Design of a Parallel Architecture Robotic Spine Exoskeleton with Series Elastic Actuators”, Oral presentation	Aug. 8 th , 2017 Cleveland, OH

CONFERENCE PROCEEDINGS

- [1] **C. Ophaswongse**, P. M. Puma, I. Daley, V. Santamaria, and S. K. Agrawal, “Training Seated Postural Coordination in a Virtual Reality Reaching Game by Active Pelvic Guidance from a Robotic Exoskeleton,” in *Proceedings of the 2024 10th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob)*, Heidelberg, Germany: IEEE, Sep. 2024, pp. 1655–1662. doi: 10.1109/BioRob60516.2024.10719943.
- [2] **C. Ophaswongse**, V. Lent, and S. K. Agrawal, “Kinematic Validation of a Robotic Exoskeleton for Assisting Seated Pelvic Movements by Wheelchair Users with Trunk Impairments,” in *Proceedings of the 2022 9th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob)*, vol. 2022-Aug, Seoul, Korea, Republic of: IEEE, 2022, pp. 1–6. doi: 10.1109/BioRob52689.2022.9925527.
- [3] **C. Ophaswongse**, R. Murray, and S. Agrawal, “Design of a parallel architecture robotic spine exoskeleton with series elastic actuators,” in *Proceedings of the ASME 2017 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC)*, vol. 5A: 41st Mechanisms and Robotics Conference, Cleveland, OH, USA, Aug. 2017. doi: 10.1115/DETC2017-67842.

JOURNAL PUBLICATIONS

- [4] **C. Ophaswongse** and S. K. Agrawal, “Optimal Design of a Novel 3-DOF Orientational Parallel Mechanism for Pelvic Assistance on a Wheelchair: An Approach Based on Kinematic Geometry and Screw Theory,” *IEEE Robotics and Automation Letters*, vol. 5, no. 2, pp. 3315–3322, Apr. 2020. doi: 10.1109/LRA.2020.2975720.
- [5] R. C. Murray, **C. Ophaswongse**, J. Park, and S. K. Agrawal, “Characterizing Torso Stiffness in Female Adolescents With and Without Scoliosis,” *IEEE Robotics and Automation Letters*, vol. 5, no. 2, pp. 1634–1641, Apr. 2020. doi: 10.1109/LRA.2020.2969945.
- [6] **C. Ophaswongse**, R. C. Murray, V. Santamaria, Q. Wang, and S. K. Agrawal, “Human Evaluation of Wheelchair Robot for Active Postural Support (WRAPS),” *Robotica*, vol. 37, no. 12, pp. 2132–2146, Dec. 2019. doi: 10.1017/S0263574719000948.
- [7] R. C. Murray, **C. Ophaswongse**, and S. K. Agrawal, “Design of a Wheelchair Robot for Active Postural Support,” *Journal of Mechanisms and Robotics*, vol. 11, no. 2, pp. 20911–20919, Feb. 2019. doi: 10.1115/1.4042544.
- [8] S. Keeratihattayakorn, C. Virulsri, **C. Ophaswongse**, and P. Tangpornprasert, “Design and evaluation of a hydraulic mechanism with available components for passive knee prostheses,” *Disability and Rehabilitation: Assistive Technology*, pp. 1–8, Sep. 2019. doi: 10.1080/17483107.2019.1642396.
- [9] **C. Ophaswongse**, R. C. Murray, and S. K. Agrawal, “Wrench Capability of a Stewart Platform With Series Elastic Actuators,” *Journal of Mechanisms and Robotics*, vol. 10, no. 2, pp. 21002–21008, Jan. 2018. doi: 10.1115/1.4038976.

PROFESSIONAL ASSOCIATIONS

- American Society of Mechanical Engineers (ASME): Member
- Institute of Electrical and Electronics Engineers (IEEE): Member

Journal/Conference Manuscript Reviewer

2017 – Present

- Robotica, 2024
- ASME Journal of Mechanisms and Robotics (JMR), 2024
- ASME International Mechanical Engineering Congress & Exposition (IMECE), 2024
- IEEE International Conference for Biomedical Robotics and Biomechatronics (BioRob), 2024
- IEEE Transactions on Neural Systems and Rehabilitation (TNSRE), 2024
- IEEE Transactions on Biomedical Engineering (TBME), 2024
- IEEE Transactions on Neural Systems and Rehabilitation (TNSRE), 2023
- IEEE Robotics and Automation Letters (RA-L), 2023
- ASME 47th Mechanisms and Robotics Conference (MR), 2023
- IEEE International Conference on Robotics and Automation (ICRA), 2023
- IEEE Robotics and Automation Letters (RA-L), SI: Intelligent Human-Robot Interaction for Rehabilitation and Physical Assistance, 2018
- IEEE Robotics and Automation Society (RAS) 18th International Conference on Humanoid Robots (Humanoids), 2018
- IEEE International Conference on Intelligent Robots and Systems (IROS), 2017

VOLUNTEER AND OUTREACH ACTIVITIES**Tikkun Olam Makers (TOM): Columbia University Makeathon, New York, NY**Feb. 21st – 23rd, 2020

- Led the mechanical design, CAD, and manufacturing process in a three-day fast-paced prototyping of affordable products (\$500 budget) to solve neglected challenges of people with disabilities
- Collaborated with six teammates from diverse backgrounds: mechanical, biomedical, software engineers, product manager, occupational therapist, and a “need-knower” who is a quadriplegic wheelchair user with Charcot-Marie-Tooth (CMT) disease
- Built a 5-DOF tabletop robot that can move and tilt a brush to create strokes in kanji characters
- Won the most innovative project award among six teams in the event

Mentorship for a high school student from the Bronx High School of Science, Bronx, NY

2017 - 2018

- Supervised development of Posture Monitoring Shirt (PoMS): a comfortable shirt that utilizes Machine Learning to generate posture-defining coordinate transforms based on electrical resistance from stretch sensors
- Student mentee achieved the top 300 scholars in the Regeneron Science Talent Search through this project
- Filed an invention report to the Columbia Technology Ventures Office

NSF STEM Outreach Internship Program with Marymount High School, New York, NY

Summer 2018

- Collaborated with a science teacher and mentored two high school students who are interested in robotics and its human applications as part of Grant NSF IIS-1527087, Dynamic Braces for Quantification and Treatment of Abnormal Curves in the Human Spine
- Guided hardware and software preparation for a posture training experiment using Robotics Spine Exoskeleton (RoSE)

Hk Maker Lab Internship for a high school student from Francis Lewis High School, Fresh Meadows, NY

Summer 2017

- Supervised development of spring-loaded modules for an unpowered RoSE for potential treatment of adolescent idiopathic scoliosis
- Instructed robotic fundamentals and prototype development, including mechanical design, CAD, electronics, and 3D printing

REFERENCES

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