Chawin Ophaswongse

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Education

Columbia University — New York, NY
Doctor of Philosophy (Ph.D.) in Mechanical Engineering (GPA 4.00/4.00) — Jan. 2018 - Oct. 2021
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) — Aug. 2016 - Dec. 2017

Chulalongkorn University — Bangkok, Thailand
Bachelor of Engineering (B.E.) in Mechanical Engineering (GPA 3.90/4.00, 1st Class Honors, Gold Medal Award) — May 2011 - Jul. 2015

Grants and Awards

Individual Postdoctoral Fellowship in Spinal Cord Injury Research — 2023 - 2025
New York State Spinal Cord Injury Research Board (SCIRB), New York State Department of Health

Innovative, Developmental, or Exploratory Activities (IDEA) Grant in Spinal Cord Injury — 2021 - 2023
New York State Spinal Cord Injury Research Board (SCIRB), New York State Department of Health

Anandamahidol Foundation Scholarship under the Patronage of His Majesty the King of Thailand — 2015 - 2021
Unconditional full-ride scholarship for graduate studies, one of just two awarded nationwide in the field of engineering

Academic Excellence in Graduate Studies, M.S. in Mechanical Engineering Class of 2018 — 2018
Among the top 10% of students with the highest GPAs from a total of $\sim$ 70 students, Columbia University, NY

Gold Medal Award for achieving the highest GPA in the Mechanical Engineering Department ($\sim$100 students) — 2015
Faculty of Engineering, Chulalongkorn University, Bangkok, Thailand

Outstanding Senior Project Award: 2nd Place Senior Project out of 41 Projects in the Academic Year 2014 — 2015
Department of Mechanical Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok, Thailand

Dean's List throughout undergraduate studies — 2011 - 2014
Faculty of Engineering, Chulalongkorn University, Bangkok, Thailand

Experience

Robotics And Rehabilitation Laboratory (ROAR Lab), Columbia University — New York, NY
Postdoctoral Fellow | Advisor: Sunil K. Agrawal, Ph.D. — Oct. 2021 - Oct. 2025
Graduate Research Student — Jul. 2016 - Oct. 2021
Main Project: Wheelchair Robot for Active Postural Support (WRAPS) for users with trunk impairments

- Invented robotic torso exoskeletons to assist seated postural movements for individuals with cervical or thoracic spinal cord injury (SCI)
- Formulated a novel robotic mechanism optimization using motion capture to maximize ergonomics and transmission efficiency
- Led a cross-disciplinary team in developing a ROS-integrated VR/AR training platform combining Unity-based tasks, seat pressure sensing, haptic interfaces, and real-time robot control, validated in experiments with over 50 human participants
- Developed an adaptive impedance control architecture leveraging Gaussian Mixture Models (GMM) and Deep Neural Networks (DNN) for reach posture–phase prediction, implemented within a custom C++ dynamics model with online Lyapunov-based stability enforcement
- Implemented bilateral teleoperation of robotic exoskeletons using a 6-DOF haptic interface for safe therapist-patient interaction
- Designed and implemented calibration test rigs equipped with a 6-axis force/torque sensor to validate end-effector wrench estimation from joint torques (amplitude error <10%), enhancing the reliability of human-robot interaction force monitoring across the workspace

Regional Center of Robotics Technologies, Chulalongkorn University — Bangkok, Thailand
Research Assistant | Advisor: Viboon Sangveraphunsiri, Ph.D. — Aug. 2015 - Jun. 2016
Main Project: Upper-limb Rehabilitation Robot for Stroke Patients

- Designed and built a 2-DOF five-bar robot for upper-limb stroke rehabilitation, deployed at King Chulalongkorn Memorial Hospital
- Led mechanical design calculations and CAD modeling in CATIA, achieving sub-millimeter deflection under a 20 kg end-effector load
- Developed position and impedance controllers in C++ on AC servo motors via low-latency communication using a Sensoray DAQ board

Center of Excellence for Prosthetic and Orthopedic Implant, Chulalongkorn University — Bangkok, Thailand
Research Assistant | Advisor: Pairat Tangpornprasert, Ph.D. — Jun. 2014 - Jul. 2015
Senior Capstone Research Project: "Design of a Hydraulic Knee Prosthesis Using a Valve Controlling Mechanism"

- Led a 3-person team to design and prototype a low-cost mobile hydraulic system for a passive knee prosthesis, enabling stance-phase locking and swing-phase damping; awarded 2nd place out of 41 senior projects and published the design in a peer-reviewed journal
- Conducted simulations in MATLAB Simulink to optimize component sizing for off-the-shelf and custom hydraulic elements

Triumph Aviation Services - Asia, Ltd. (TASA) — Chonburi, Thailand
Aerospace/Mechanical Engineering Intern, Reverse Engineering Team, Repair Product Line — Mar. 2014 - May 2014

- Established a 3D database of mechanical components in Auxiliary Power Units (APUs) using a FARO 3D scanner and reverse engineering software (Polyworks Inspector, Geomagic Design X), ensuring GD&T compliance and adherence to FAA maintenance standards
- Developed a 3D SOLIDWORKS model of an APU shipping stand for in-house handling and transportation

Invited Talks and Presentations

Guest Speaker, Graduate-level Course in Rehabilitation Engineering — Oct. 7th 2025
"Design of a Robotic Pelvic Exoskeleton to Enhance Seated Postural Control in Wheelchair Users" — Texas, TX
Oral presentation delivered online at University of North Texas (UNT)

Columbia University Postdoctoral Research Symposium — May. 3rd 2024
"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 — New York, NY

Robotics and Human Health: Assessment and Rehabilitation Workshop — Jun. 2nd 2023
"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 — Sousse, Tunisia

Tikkun Olam Makers (TOM) Talks: Medical Design — Mar. 15th, 2021
"Wheelchair Robot for Active Postural Support (WRAPS) for Users with Impairment of the Trunk" — New York, NY
Oral presentation delivered online as collaboration between Pratt Institute and Columbia University

IEEE International Conference on Robotics and Automation (ICRA), 2020 — Jun. 3rd, 2020
"Optimal Design of a Novel 3-DOF Orientational Parallel Mechanism for Pelvic Assistance on a Wheelchair" — Paris, France
Oral presentation delivered online at the fully virtual conference

NYS Spinal Cord Injury Research Symposium 2018 — Oct. 16th, 2018
"Wheelchair Robot for Active Postural Support (WRAPS) for SCI Patients" — New York, NY
Poster presentation delivered at The Rockefeller University

ASME 41st Mechanisms and Robotics Conference, 2017 — Aug. 8th, 2017
"Design of a Parallel Architecture Robotic Spine Exoskeleton with Series Elastic Actuators", Oral presentation — 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. 20 911–20 919, 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. 21 002–21 008, Jan. 2018. DOI: 10.1115/1.4038976.

Professional Associations

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

Editorial Work

Journal/Conference Manuscript Reviewer 2017 – Present

- IEEE Robotics and Automation Letters (RA-L), 2025
- Disability and Rehabilitation: Assistive Technology, 2025
- 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

Mentorship for a high school student from Edgemont Jr./Sr. High School, Scarsdale, NY Summers 2024 – 2025

- Mentored student in developing PTInspect, an AR-based rehabilitation tool integrating Unity/C#, real-time motion tracking, and CAD-designed custom hardware to support therapist-assisted reach training
- Guided on system architecture, prototyping iterations, calibration methodology, and technical alignment with clinical rehab goals
- Student won IBM Visionary Engineer Award (WESEF) and 3rd place GENIUS Olympiad; submitted to Regeneron Science Talent Search

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

- Led hardware design, CAD, and fabrication in a 3-day rapid prototyping challenge to create assistive technology under $500
- Collaborated with a multidisciplinary team—including engineers, a product manager, an occupational therapist, and a quadriplegic "need-knower" with Charcot–Marie–Tooth (CMT) condition—to co-design user-centered solutions
- Built a 5-DOF tabletop robot capable of brush-based kanji character rendering; awarded "Most Innovative Project" among six teams

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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