Johannes James — Ph.D.

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Education

Ph.D. & MS in Mechanical Engineering, University of Washington. GPA 3.6 **2024**
Thesis: *Power and Actuation Autonomy for Flying Insect Robots.* Advisor: Sawyer Fuller

BS in Mechanical Engineering, California Maritime Academy. GPA 3.9 **2013**
Capstone: *Torque, Power, and Speed Feedback Control of a Continuously Variable Transmission*

Research & Media Coverage

Wireless Power, Power Electronics, & Waveform Generation for Flying Insect Robots (FIR)

◆ Achieved the first-ever wireless lift-off of an FIR powered solely by onboard systems [1]. This momentous first-author result was the first time an insect sized robot did *anything* without wires attached, and received global media attention including The Economist, Wired, IEEE Spectrum, CNBC, TechXPlore, Daily Mail, and Seeker.

◆ Achieved the first demonstration of independent wing actuation by onboard power electronics with reduced weight and doubled efficiency and effective power capacity of untethered FIRs, unlocking technological advancement of flying insect robots. Took new designs from pen and paper through simulation to fabrication and deployment, originating new technologies.

◆ Successfully generated high-voltage low-distortion waveforms to modulate thrust for roll torque and altitude control, a first-in-field result. Originated an onboard controller to learn unknown control signals for flapping online [2].

◆ Achieved flight-weight and flight-sufficient power transfer with new resonant coil design and fabrication of magnetically coupled resonators [3].

Work Experience

◆ **Licensed Engineering Officer, U.S. Merchant Marine** 2013–2016
  - USCG A/E Unlimited HP Steam/Motor/Gas Turbine in steam and diesel powered ships.
◆ **130' M/V Island Spirit** 2004–2009 (Full-time) 2009-2019 (Intermittent)
  - 100-Ton Inland Master. Captain, First Mate, Chief Engineer, Port Engineer.

Technical skills

◆ **Programming Languages and Software:**
  - **Proficient in:** C, Python, MATLAB, Simulink, LabVIEW, MS VBA, TeX.
  - **Familiar with:** PLC Ladder Logic, Node Red, CNC/gcode, JavaScript, HTML.
◆ **Engineering and Design Tools:**
  - **Proficient with:** Spice, MATLAB Simscape, Draftsite/QCAD, PTC Creo Parametric, Inkscape graphics, KiCad/Eagle, LightBurn, Slic3r.
  - **Familiar with:** EM FEA simulation software.
◆ **Hardware Prototype Fabrication:**
  - **Proficient with:** analog and digital electronics design/repair, including surface mount circuit fabrication/repair; 3D printing and laser cutting; plumbing and electrical work
  - **Familiar with:** machining; soldering/brazing; MIG/TIG/stick welding on steel and aluminum.

Publications

[1] **James, Johannes**, Vikram Iyer, Yogesh Chukewad, Shyamnath Gollakota, and Sawyer B. Fuller. Liftoff of a 190 mg laser-powered aerial vehicle: The lightest wireless robot to fly. In *2018 IEEE International Conference on Robotics and Automation (ICRA)*, pages 3587–3594, 2018. doi: 10.1109/ICRA.2018.8460582.

[2] **James, Johannes** and Sawyer Fuller. A high-voltage power electronics unit for flying insect robots that can modulate wing thrust. In *2021 IEEE International Conference on Robotics and Automation (ICRA)*, pages 7212–7218. IEEE, 2021.

[3] **Johannes James**, Xingyi Shi, Joshua R. Smith, and Sawyer B. Fuller. Magnetically coupled resonators for wireless power transmission to insect sized flapping wing robots. In *Hilton Head Workshop 2024: A Solid-State, Sensors, Actuators, and Microsystems Workshop*, Hilton Head, SC, June 2024. ACM Press.

[4] Vikram Iyer, Ali Najafi, **James, Johannes**, Sawyer Fuller, and Shyamnath Gollakota. Wireless steerable vision for live insects and insect-scale robots. *Science robotics*, 5(44), 2020.

[5] Sivakumar Balasubramanian, Yogesh M. Chukewad, **James, Johannes M.**, Geoffrey L. Barrows, and Sawyer B. Fuller. An insect-sized robot that uses a custom-built onboard camera and a neural network to classify and respond to visual input. In *2018 7th IEEE International Conference on Biomedical Robotics and Biomechatronics (Biorob)*, pages 1297–1302, 2018. doi: 10.1109/BIOROB.2018.8488007.

[6] Yogesh M. Chukewad, Avinash T. Singh, **James, Johannes M.**, and Sawyer B. Fuller. A new robot fly design that is easier to fabricate and capable of flight and ground locomotion. In *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 4875–4882, 2018. doi: 10.1109/IROS.2018.8593972.

[7] Yogesh M Chukewad, **James, Johannes**, Avinash Singh, and Sawyer Fuller. Robofly: An insect-sized robot with simplified fabrication that is capable of flight, ground, and water surface locomotion. *arXiv preprint arXiv:2001.02320*, 2020.

Teaching

- **Best TA Award (2021)**: Recognized for exceptional dedication and quality in teaching within the Department of Mechanical Engineering.
- **ME 473 Instrumentation**: Instructor of Record 2022 & 2023. Dynamic system instrumentation and actuators, covering motors, inertial measurement units, and industrial sensors. Emphasized hands-on skills with oscilloscopes, circuit prototyping, and software in LabVIEW, MATLAB Simulink, Python.
- **ME 477 Embedded Systems**: TA. Advanced course on programming microcontrollers with a focus on embedded control systems and C programming.
- **AA/EE/ME 581 Digital Controls**: TA. Classical control design and implementation for automatic feedback control. Designed and taught entire lab courses in MATLAB Simulink + Simscape and physical implementation, and used LabVIEW and Circuitpython extensively.
- **ME 373/374 System Dynamics**: TA. Core course in systems and dynamics theory for the mechatronics concentration, covering foundational concepts in dynamical systems.