Frank J. Regal

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CURRENT AFFILIATION:

Graduate Research Assistant

Nuclear and Applied Robotics Group — Started June 2021
The University of Texas at Austin — *Austin, TX*

EDUCATION:

The University of Texas at Austin

Doctor of Philosophy (PhD) Mechanical Engineering — Expected Grad: May 2025
Focus: Hazardous Environment Mobile Robotics & Human-Robot Interactions — *Austin, TX*

Drexel University

Master of Science (MS) Mechanical Engineering — Graduated June 2019
Latin Honors: Summa Cum Laude; Focus: Control Theory — *Philadelphia, PA*

Bachelor of Science (BS) Mechanical Engineering — Graduated June 2019
Latin Honors: Summa Cum Laude — *Philadelphia, PA*

ACADEMIC AND PROFESSIONAL EXPERIENCE:

Graduate Student Researcher — June 2022 – Present
Argonne National Laboratory | AMD Robotics and Remote Systems Division — *Lemont, IL*

- Integrated one HoloLens 2 headset and one ROS based dual arm robot, with C# and Unity, to provide an enhanced remote teleoperation interface allowing for the control of the robot from a holographic model.
- Developed and implemented the pipeline required to send, receive, and display robot joint state data, point cloud data, image data, and hand tracking data from a HoloLens 2.
- Developed virtual fixtures for the HoloLens 2 mixed reality device to assist robotic operators to remotely teleoperate remote dual arm robots to cut physical objects in precise straight lines.
- Assembled and commissioned a new dual arm setup created from two Kinova Gen3 Lite 7DOF robotic arms to perform various manipulation tasks inside of shielded nuclear radiation containment chambers.

Graduate Research Assistant — June 2021 – Present
The University of Texas at Austin | Nuclear and Applied Robotics Group — *Austin, TX*

- Integrated one augmented reality (AR) headset and one ROS based drone, with C++ and Unreal Engine, to provide AR users a holographic overlay, pinned to the drone in space, of key information about the drone.
- Developed an object detection AR notification system that allows robots running pre-defined object detection algorithms to notify AR users with what the robots found with a real time image of the object from the robot.
- Created one AR graphical user interface (GUI) to spawn virtual spatial anchors that AR headsets and robots can localize to, along with two other AR GUI's for setting up the AR headset names and server addresses.
- Worked with one partner to create and integrate a custom SLAM package for a ROS based Ackermann steering car with LiDAR (obstacle avoidance, localization, map matching, and an RRT global planner were all scripted in C++).

Innovation Focal Point — Aug. 2020 – June 2021
The Dow Chemical Company | Houston Hub Innovation Team — *Houston, TX*

- Managed a team of 15 people to continuously drive proof of concept projects across five Houston facilities focused on drones, 3D printing, robotics, plant automation, mobilization, and elevated work alternatives.
- Facilitated, organized, and implemented a five-year multi-generational innovation plan and developed a cross functional innovation team, communication plan, and automated tracking and savings.
- Introduced and fully integrated a new virtual reality headset across five facilities, for remote video conferencing, through the creation of value cases, project charters, and work process and management of change documentation.

Mechanical Design Engineer Aug. 2019 – June 2021

The Dow Chemical Company | Technical Expertise & Support (TES) *Houston, TX*

- Headed a global team of three on four mechanical design projects focused on the design and installation of one pressure vessel, two pumps, one water well, and the modification of six pressure vessels with India team
- Reverse engineered, designed, analyzed, and developed custom process equipment upon request from maintenance (i.e. 6-foot diameter diffuser mounts, custom process flanges, custom dip pipes, etc.).
- Ensured drawings and specifications were clear and met all Dow Internal, ASME, ANSI, and ASTM local and national standards for process pumps, pressure vessels, water wells, and tanks.
- Performed minimum thickness calculations and stress analyzes per maintenance and piping requests.
- Produced three cost and team hour estimates, one technical equipment package, one construction bid package, and an inquiry and order MST (material selection transmittal) package for each capital project.
- Aided in the enhancement of workshare efficiency between Dow's Chennai, India Engineering Center (CEC), as the team CEC Focal Point, to improve project workflow and drive cost metrics below industry standard.

Undergraduate Research Assistant Sept. 2018 – June 2019

Drexel University | Theoretical and Applied Mechanics Group *Philadelphia, PA*

- Developed, configured, and modified five drones, via 3D printing, for structural health monitoring projects, 3D modeling projects, and a small-scale package delivery project.
- Designed and managed three controlled urban environment UAV tests for visual, thermal, and acoustic data capturing for a research project funded by Lockheed Martin through DARPA.
- Oversaw and provided expertise to a team of 14 students as a teaching assistant for ENGR 370 VIP Drone Course, which designed a drone and competed at the Vertical Flight Societies 75th Forum.

Robotics Engineer (Co-op) April 2018 – Sept .2018

The Dow Chemical Company | Digital Operations Center *Lake Jackson, TX*

- Headed the design, development, manufacturing, and testing of a wireless electro-mechanical magnetic inspection robot used for NDT (Non-Destructive Testing) on vertical boiler pipe walls which saved an estimated $400k per year.
- Designed a high tolerance linear actuated mobile storage container used to collect plant fouling samples remotely through the use of rapid prototyping and design for additive manufacturing (DfAM) techniques.
- Facilitated the development of a 3D printed "digital warehouse" through the identification, replication, and fabrication of consumable plant process equipment that yielded an estimated total of $100k in savings.
- Researched current market robotic solutions, assisted with capital purchasing efforts, and created informational manuals to promote newly developed in-house robotic solutions globally across 113 plants in 31 countries.

TECHNICAL SKILLS:

Software: ROS, Unreal Engine 4, Unity, Perforce, Robofleet, Solidworks, ANSYS, Codeware Inspect, Intergraph Smart 3D, LFM, AutoCAD, PTC Creo, LabVIEW, NXT, Maple, Mathematica, R, Arduino IDE, JMP, Microsoft Visio, Autodesk ReCap, Autodesk Fusion 360, Microsoft Office Suite, Git, Simplify3D, Blender, MeshLab, Unity

Program: C++ (Advanced), Python (Advanced), MATLAB (Advanced), C# (Proficient), HTML (Proficient), JavaScript (Proficient)

PUBLICATIONS:

Conference Proceedings:

1. ***Regal, F.***, Petlowany, C, Pehlivanturk, C, Van Sice, C., Suarez, C., Anderson, R., and Pryor, M., "AugRE: Augmented Robot Environment to Facilitate Human-Robot Teaming and Communication," *31st IEEE Annual Conference on Robot and Human Interactive Communication (RO-MAN)*, Naples, Italy, August 2022.

Invited Talks and Presentations:

2. **Regal, F.** and Petlowany, C, "AugRE: Augmented Robot Environment", *Sandia National Laboratory 4th Annual XR Conference,* Virtual, July 2022.

3. **Regal, F.** and Petlowany, C, (Poster Presentation) “AugRE: An Augmented Reality Tool for Supervising, Coordinating, and Commanding Robotic Agents”, *Texas Regional Robotics Symposium (TEROS),* Austin, TX, April 2022
4. **Regal, F.** and Petlowany, C, “AugRE: An Augmented Reality Tool for Supervising, Coordinating, and Commanding Robotic Agents”, *Texas Immersive Institute (TXI) Research Lightning Talk*, Austin, TX, February 2022.
