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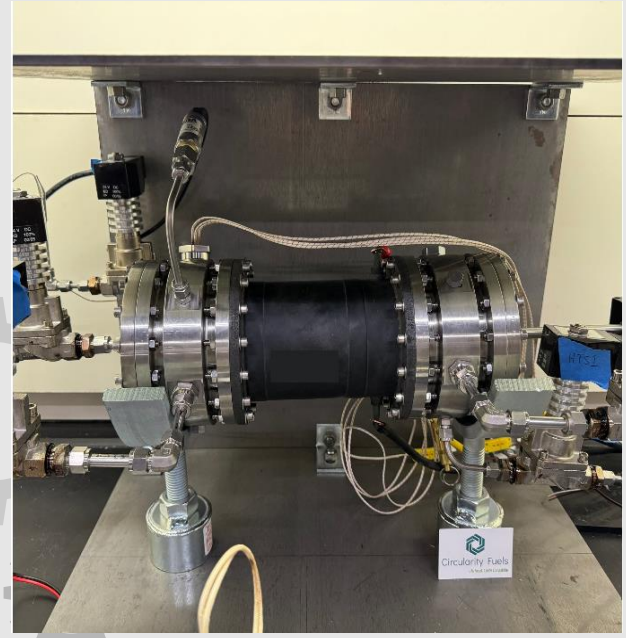
Chemical Pilot Reactor

Role: Mechanical Engineering Intern
Duration: Aug 2024 – Jan 2025



System Overview

Designed and optimized a chemical reactor system for efficient catalyst integration, improving reaction kinetics and thermal management.

Key Contributions:

✓ **Reactor Structural Design** – Developed SolidWorks-based reactor layout within a shipping container.

✓ **Inlet & Outlet Design** – Engineered precise inlet and outlet configurations for fluid and gas flow, ensuring optimal process efficiency and safety.

✓ **HVAC & Ventilation System** – Integrated HVAC ducts for temperature control, ventilation, and safe exhaust of gases.

✓ **Piping & Instrumentation Diagram (P&ID)** – Developed a comprehensive P&ID outlining the system's process flow, instrumentation, and safety controls.

✓ **Structural & Safety Considerations** – Ensured container modifications met mechanical integrity, fire safety, and pressure regulations.

✓ **Modular & Transportable Design** – Engineered the reactor to be fully functional while maintaining mobility and adaptability for different locations

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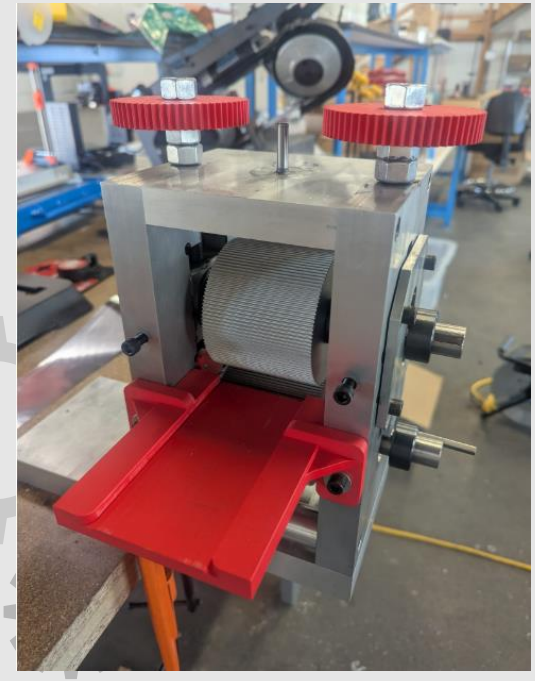
Corrugating Jig

Role: Mechanical Engineering Intern
Duration: Aug 2024 – Jan 2025



System Overview

Designed a corrugating jig to efficiently shape sheets using theoretical calculations, incorporating spring back effects and air bending principles to ensure precise deformation.

Key Contributions:

✓ **Theoretical Analysis & Design** – Conducted in-depth calculations to predict and compensate for spring back effects, optimizing the accuracy of the corrugation process.

✓ **Prototype Development** – Created and tested **3D-printed gears** to analyze the corrugation pattern before transitioning to a full-scale metallic jig.

✓ **Metallic Jig Fabrication** – Engineered and built a **durable metallic jig**, ensuring repeatable, high-precision corrugation for sheet materials.

✓ **Process Optimization** – Refined the jig's performance by evaluating material properties, bending angles, and force distribution for improved efficiency.

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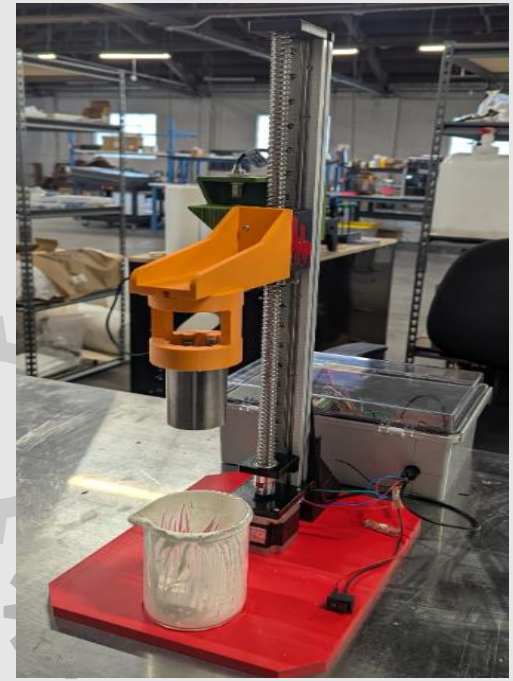
Dip Coating Jig

Role: Mechanical Engineering Intern
Duration: Aug 2024 – Jan 2025



- **System Overview**

Designed a jig for coating chemicals onto catalysts, integrating automation and precision control for consistent application..

- **Key Contributions:**

✓ **Automation & Control System** – Utilized a linear actuator controlled via Arduino IDE, employing a stepper motor controller, ESP32 module, and relay switches to enable precise motion control.

✓ **Electronic Integration** – Developed a custom-coded control system to regulate dipping cycles, ensuring accurate and repeatable chemical coating processes.

✓ **Prototyping & Fabrication** – Designed and manufactured all structural components using 3D printing, optimizing the jig for functionality, cost-effectiveness, and ease of modification.

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Takeaways from the Internship

✓ Gained hands-on experience in chemical reactor system.

✓ enhanced in-house prototyping skills and developed expertise in plumbing, hardware integration, and Piping & Instrumentation Diagrams for system design and optimization.

✓ Developed a good foundation in reaction mechanisms, catalyst behavior, and process optimization within the chemical reactor system.