DUNCAN MCGOUGH

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EXPERIENCE

Space Exploration Technologies Corporation (SpaceX) June 2020 - Present
Software Engineer (2024), Propulsion Engineer (2020) *Hawthorne, CA*

sx_fluids Python Library

- Created widely-used thermal fluids simulation Python library, `sx_fluids`, to model real/multiphase fluids
- Developed CI/CD/K8s pipeline and monorepo with automated testing and coverage analysis, including extensive documentation
- Trained analysts and team members on software engineering best practices, allowing for regular contribution

Starship Tank Press Model

- Developed primary tank pressure simulator, now essential for flying Starship
- Leverages `sx_fluids`, and has features for easy analyst accessibility and high-performance computing (HPC) tooling

Rust Thermophysical Property Library Tools

- Developed thread-safe wrappers for REFPROP (includes Python API), improving performance by several orders of magnitude
- Created high-performance Peng-Robinson equation-of-state library with robust error handling to compliment REFPROP

Thermal Fluids Webapp Ecosystem

- Created Kubernetes-hosted webapp suite and ecosystem for performing quick trades and calculations, saving time for analysis teams
- Designed ecosystem for team contribution, which has now been adopted and is regularly-used

CFD Models

- Built multiphase slosh models for Starship ascent and microgravity phases, optimizing mass-to-orbit and mission success
- Created multiphase vapor-pullthrough models to minimize propellant residual by several tonnes and assess flight risk
- Constructed highly-compressible gas simulations for RCS thrusters and tank-internal press gas diffusers
- Aforementioned CFD models have been built-upon and are still used; support/training is regularly shared

Space Exploration Technologies Corporation (SpaceX) Summers 2018, 2019
Satellite Development Intern (2018), Associate Engineer - Post Grad, Thermal-Fluid Analysis (2019) *Hawthorne, CA*

- Developed Starlink hall-effect thruster thermal model to determine duty cycle and improve performance. Reduced bus mass.
- Analyzed Dragon spacecraft Draco hypergolic engine, bounding fault cases for propellant unsettling
- Created satellite thermal models of star trackers, propellant tanks, and propulsion avionics, used by qualification team
- Analyzed Falcon 9 S2 fuel baffle leakage; discovered unacceptable leakage

Roccor LLC May 2017 - August 2017
Thermal Engineering Intern, Thermal Group *Longmont, CO*

- Engineered thermal vacuum chamber for deployable composite CubeSat radiators. Met NASA/Roccor project requirements, budgets, and deadlines. Advised manufacturing of chamber. Designed and simulated, validating with test data.

COBRA "Spaceshot" Suborbital Rocket Development Team March 2016 - January 2018
Propulsion Lead *Boulder, CO*

- Manage propulsion subteam. Modeled oxidizer injector assembly and used CFD and FEA to validate designs. Calculated nozzle geometry and flow rates. Designed liquid oxidizer storage and delivery/injection systems for a hybrid rocket.

Gridded Electrostatic Ion Thruster Research BalloonSat Project January 2016 - May 2016
Team Lead *Boulder, CO*

- Led a team to design, test, and fly a high-altitude BalloonSat payload. Developed, researched, and constructed a low-cost gridded electrostatic ion thruster to test at altitude for deployment upon CubeSats.

EDUCATION

University of Colorado, Boulder August 2015 - Present

Engineering Honors Program, Chancellor's Scholarship	
Masters of Science, Aerospace Engineering Sciences with focus on Fluids and Propulsion	May 2020
Bachelor of Science, Aerospace Engineering Sciences	May 2019
Bachelor of Music, Violin Performance (College of Music Scholarship Award)	August 2015 - May 2016

STRENGTHS AND SKILLS

Languages	Rust, Python, MATLAB, Julia, C++
Frameworks	Docker, Kubernetes, Maturin/PyO3, Leptos, Clap (Rust CLI), Tokio, Axum, Serde, Flask, Traefik
Software	STAR-CCM+, OpenFOAM, ANSYS, Thermal Desktop, CAD (SolidWorks, NX)
OS	Linux, OSX, Windows, slurm (HPC), ProxMox, using Virtual Machines
Personal Interests	Violin, freeride skiing, mountain biking, martial arts, spikeball, FPV drones