

# CRISTIAN LACEY

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## Education

### Princeton University

PH.D. IN MECHANICAL AND AEROSPACE ENGINEERING, ADVISOR: **MICHAEL E. MUELLER**, GPA: **4.00/4.00**

Princeton, NJ

Expected May 2023

### The Cooper Union

B.E. IN MECHANICAL ENGINEERING, GPA: **3.98/4.00**

New York, NY

May 2018

## Honors

2019	<b>Sayre Award for Academic Excellence</b> , Highest-ranking graduate student after first year.	Princeton University
2019	<b>Daniel and Florence Guggenheim Foundation Fellowship</b> , Competitive second-year fellowship.	Princeton University
2018	<b>Gordon Y. S. Wu Fellowship in Engineering</b> , Competitive first-year fellowship.	Princeton University
2018	<b>Henri D. Dickinson Award</b> , Highest cumulative ranking upon graduation.	The Cooper Union
2018	<b>Alexander C. Grove Memorial Prize</b> , For scholarship, personal integrity, and professional promise.	The Cooper Union
2018	<b>The Mechanical Engineering Design Prize</b> , For excellence in mechanical design.	The Cooper Union
2016	<b>Tyler G. Hicks Mechanical Engineering Prize</b> , For academic achievement during the first two years.	The Cooper Union
2015	<b>Howard Silfin Mechanical Engineering Internship Award</b> , For ability to conduct quality research.	The Cooper Union
2014	<b>Half-tuition scholarship</b> , Merit scholarship for all four years.	The Cooper Union

## Peer-Reviewed Publications

- **Lacey, C.E.**, Novoselov, A.G., Mueller, M.E., In-Situ Adaptive Manifolds: Enabling computationally efficient simulations of complex turbulent reacting flows, *Proceedings of the Combustion Institute* 38 (2019) accepted for presentation.
- Novoselov, A.G., **Lacey, C.E.**, Perry, B.A., Mueller, M.E., Large Eddy Simulation of a turbulent lifted flame using multi-modal manifold-based models: Feasibility and interpretability, *Proceedings of the Combustion Institute* 38 (2019) accepted for presentation.

## Conference Papers & Presentations

- **Lacey, C.E.**, Novoselov, A.G., Mueller, M.E., In-Situ Adaptive Manifolds: Enabling simulations of complex turbulent reacting flows, Spring Technical Meeting of the Eastern States Section of the Combustion Institute, Columbia, SC, March 8-11, 2020.
- Novoselov, A.G., **Lacey, C.E.**, Mueller, M.E., Multi-modal manifold-based modeling of turbulent lifted flames, Spring Technical Meeting of the Eastern States Section of the Combustion Institute, Columbia, SC, March 8-11, 2020.
- Baglione, M., Chin, A., Faddoul, R., **Lacey, C.E.**, Mosin, A., Rundell, J., Zhang, O., Optimizing condenser water supply temperature to minimize energy usage, 2020 ASHRAE Winter Conference, Orlando, FL, February 1-5, 2020.
- **Lacey, C.E.**, Novoselov, A.G., Mueller, M.E., In-Situ Adaptive Manifolds: Enabling simulations of complex turbulent reacting flows, 72nd Annual Meeting of the APS Division of Fluid Dynamics, Seattle, WA, November 23-26, 2019.
- Novoselov, A.G., **Lacey, C.E.**, Mueller, M.E., Large Eddy Simulations of turbulent flames using two-dimensional reduced-order manifold models, 72nd Annual Meeting of the APS Division of Fluid Dynamics, Seattle, WA, November 23-26, 2019.
- Wei, H., Bianco, V., **Lacey, C.E.**, Trubatch, A.D., Yecko, P.A., Experimental quantification of volume loss rate and flow dynamics due to a magnetically localized fluid region in a laboratory model blood vessel flow (Poster), 12th International Conference on the Scientific and Clinical Applications of Magnetic Carriers, Copenhagen, DK, May 22-26, 2018.

## Research

### High-Fidelity Manifold-Based Modeling of Turbulent Combustion

Princeton, NJ

PRINCETON UNIVERSITY

Jan. 2019 - Present

- Developing In-Situ Adaptive Manifolds (ISAM), a new computational approach for manifold-based modeling that enables more general yet computationally efficient turbulent combustion models via on-the-fly adaptive tabulation.
- Integrating ISAM with the multi-modal manifold model, facilitating simulations of realistic, multi-modal systems without any a priori information about the combustion mode.
- Generalizing manifold models to accommodate multiple inlet streams, liquid fuels, and staged combustion.
- Leveraging neural networks to construct hybrid physics-based and data-based manifold models of turbulent combustion, a novel approach culminating in far more generally applicable models.

## Magnetic Nanoparticle Feedback Control System

THE COOPER UNION

New York, NY

Sept. 2017 - May 2018

- Investigated using a magnetic control system to direct drug-coated magnetic nanoparticles to disease targets, increasing the effectiveness of treatments such as chemotherapy while decreasing the side-effects.
- Designed and constructed an experimental setup comprising a closed-loop flow channel, nanoparticle cluster, webcam, stepper motors, and electromagnets on rails.
- Wrote a Python program using OpenCV to track the location of a nanoparticle cluster in real-time.
- Programmed an Arduino to actuate stepper motors and vary electromagnet strength in feedback control loop.

## Employment

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### Smith Engineering, PLLC

ENGINEERING INTERN

New York, NY

May 2017 - Apr. 2018

- Trained predictive models in Microsoft Azure Machine Learning Studio.
- Integrated machine learning models with a local PI database using Python and API requests.
- Prepared screens in PI Vision for real-time data visualization.
- Wrote Python programs to scrape data using API requests and WebDrivers.
- Built Con Edison electric and steam rate structures in MATLAB.

## Projects

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### Genetic Algorithm for Structural Design and Topological Optimization

PRINCETON UNIVERSITY

Princeton, NJ

Nov. 2018 - Jan. 2019

- Developed a Python package that employs a genetic algorithm to optimize truss structures.
- Versioned with Git and coordinated with a team to proactively avoid merge conflicts.
- Leveraged Coveralls and Codacy for code coverage evaluations and linting.
- Generated automatic documentation with Sphinx and Read the Docs.

### Analysis and Design of a Wind Turbine Tower

THE COOPER UNION

New York, NY

Oct. 2017 - Nov. 2017

- Designed a wind turbine tower to satisfy strength and deflection specifications.
- Modeled the tower geometry in SolidWorks.
- Meshed the solid geometry in ANSYS Meshing.
- Simulated the design in ANSYS APDL and Workbench.
- Documented results in final report and delivered presentation.

### CFD Analysis and Design of a Turbojet Compressor

THE COOPER UNION

New York, NY

Apr. 2017 - May 2017

- Designed the compressor stage of a turbojet engine to satisfy pressure and compression ratio specifications.
- Modeled the compressor geometry in BladeGen and SolidWorks.
- Meshed the solid geometry in HyperMesh and ANSYS Meshing.
- Simulated the design transiently in ANSYS Fluent and performed post-processing in CFD-Post.
- Documented results in final report and delivered presentation.

## Skills

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<b>Software</b>	ANSYS Fluent, ANSYS APDL, HyperMesh, SolidWorks, AutoCAD, MATLAB.
<b>Languages</b>	Python, C, Fortran.
<b>Tools</b>	Make, Git, Mercurial, UNIX command-line, $\text{\LaTeX}$ .
<b>IoT</b>	Raspberry Pi, Arduino.

## Memberships

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<b>Honor Societies</b>	Tau Beta Pi.
<b>Professional Associations</b>	The Combustion Institute, APS DFD, ASME.