GRAHAM A. FREEDLAND, PH.D.

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SUMMARY

As an engineering generalist with both academic and customer service experience, I love solving complex problems and learning something new along the way. I am currently working as an Acoustics and Vibrations Consultant at Colin Gordon Associates in Portland, Oregon where practical engineering problems and design go hand-in-hand. I completed my Ph.D in Mechanical Engineering at Portland State in 2020, studying fluid dynamics and turbulence applied to renewable energy and geophysical flows. This experience developed my scientific curiosity, ability to gather and apply a wide array of knowledge, and confidence to solve interesting projects outside my expertise. My industry experience at ASML as an Applications Engineer provided practical engineering experience where I was able to adapt my skills to excel in the fast-paced and rapidly expanding semi-conductor industry, becoming an expert in metrology, developing streamlined processes for diagnosis and analysis of on-product issues and collaborated with marketing, engineering and sales to introduce new products. As I continue to grow in this new chapter of my career, my experience stands as a testament to the importance of curiosity and creativity in engineering, what is necessary to be a disciplined and well-rounded engineer in industry, and that new and exciting opportunities are waiting for the right perspective to come along.

EDUCATION

- Ph.D., Mechanical Engineering, Portland State University, 2020
- M.S., Mechanical Engineering, Portland State University, 2016
- B.S., Aerospace Engineering, Syracuse University, 2014

WORK EXPERIENCE

Colin Gordon Associates
Consultant, Jan 2024 to present

Currently working as an Acoustic and Vibrations Consultant providing design feedback to customers for planned, new and existing construction while looking to improve the academic understanding of the impact of turbulence on vibrations in physical spaces.

ASML
Applications Engineer, Jan 2021 to Dec 2023

Worked at ASML as an DUV Applications Competency Engineer specializing in Overlay and Alignment (metrology) diagnosing on-product issues and helping introduce new technology and features.

- Transitioned from an academic background to an industrial role where I became an expert in the theory and operation of lithography scanners.
- Demonstrated ability to quickly learn and apply complex material. This was demonstrated by helping train another new engineer while I was taking the subsequent training course in parallel
- Helped develop and execute optimization projects to help customers identify new passive improvements and streamline the introduction of new technology and metrology methodology
- Participated in New Product Introduction group where I developed experiments to test and confirm the benefits of new features, modified process flows and new DUV lithography scanners.
- Operated in a rigorous 24/7 corporate environment, collaborating remotely and traveling for in-person workshops with engineers at international offices while prioritizing customer service during business interruptions and quality control.
- Led projects aimed to improve customer product quality including developing an automated solution the utilizes both in-line and offline measurements to compensate and correct for chemical degradation of wafers. This allowed customers to increase product output in low-yielding regions of the wafer.
- Developed automated Matlab solutions for indexing and extracting data from various servers, analysis for identifying on-product trends to identify quality issues, and organizing information in a clear and visually appealing format for customer presentations.
- Organized, created material for and led three workshops to train local engineers on integrating Matlab tooling with

Microsoft office, reading and extracting data from online servers, and automating analysis to significantly decrease FTE on repeated actions.

RESEARCH EXPERIENCE

Portland State University - Wind Energy and Turbulence Lab
Graduate Assistant, Sept 2017 to present

Worked in Portland State University's Wind Energy and Turbulence Lab running experiments in a large closed-loop boundary layer wind tunnel under the direction of Dr. R. Cal.

- Designed experiments and manufactured necessary equipment necessary for collection of data including personal work used in both graduate degrees.
- Operated LaVision stereoscopic particle image velocimetry systems, developed electrical signal recorders for scaled wind turbine farms with a Data Acquisition system and a range of pressure (dynamics and static) recorders for experimental data.
- Responsible for repairs, upkeep, and supervision of LaVision equipment use for stereoscopic PIV laser system.
- Developed algorithms to analyze large data sets to identify trends in statistics, perform complex mathematical transformation and summarize results in academic reports, publications, and conference presentations.

Syracuse University - Skytop Turbulence Laboratory
Undergraduate Researcher, May 2012 to May 2014

Gained first research experience working in the Skytop Turbulence Laboratory anechoic chamber under the direction of Dr. M. Glauser and Dr. J. Lewalle.

- Assisted doctoral students with construction of experimental apparatus to collect far-field pressure data from a supersonic jet with an array of microphones.
- Learned post-processing techniques and gained experience handling large data sets.
- Applied wavelet analysis to study acoustic signals and identify changes in noise production for varying nozzle designs

PROJECTS: ONGOING AND COMPLETED

High-Order Alignment Implementation Benefits
ASML, 2022 to 2023

Worked on an international team to help analyze customer data and demonstrate the benefits on higher-order wafer alignment implementation.

- Assigned as the local team liaison between the customer and team in Veldhoven.
- Demonstrated strong analysis capabilities and had my role expanded to include data analysis and algorithm development using existing Matlab tooling.
- Travelled to attend workshops, obtain high-level training and work on-site in Veldhoven.
- Wrote multiple documents to increase local team expertise and ensure increased collaboration between the local team and headquarters.

Compensating for Wafer Edge Roll-off
ASML, 2021 to 2022

Developed a solution to compensate for wafer edge roll-off through existing ASML products.

- Ran several experiments to collect on-product data and test new correction models to compensate for chemical effects on wafer production.
- Provided a comprehensive report on the benefits of data complexity reduction and modeling including limitations and optimal settings.
- Results demonstrated the capabilities of existing ASML tools that have not been utilized for on-product issues and led to a new multi-team investigation to expand on my results.

Wind Bent Volcanic Plumes (Dr. R. Cal, Primary Investigator)
Portland State University, 2014 to 2020

Current thesis work in collaboration with Dr. L. Mastin at USGS and Dr. S. Solovitz at WSU Vancouver to optimize low-order models of volcanic eruptions.

- Collected experimental data for a variety of turbulent conditions.
- Extracted fundamental turbulence parameters to quantify differences and provide quantitative relationships.
- Utilized a variety of mathematical theory to quantify common modelling parameters for both large eddy simulation (LES) and simplified entrainment models (Plumeria).
- Investigated the formation of vortex phenomenon downstream of the jet to quantify contributions to entrainment and mixing.

Biglow Wind Farm Experiments (Dr. R. Cal, Primary Investigator)
Portland State University, 2016 to 2018

- Research project in partnership with Portland General Electric to experimentally investigate passive optimization of the Biglow Wind Farm.
- First round of experiments focused on staggered/non-staggered arrays of turbines placed in a wind tunnel. Turbine blade orientation is was altered to observe effects of wake travelling.
- Second round of experiments repeated the first round but with the additional parameter of scaled topology placed to account for varying elevation.
- Third round focused on passive optimization through derating upstream turbines (reducing optimal performance) to increase downstream power output.
- Investigations yielded improvement in total power between 2-3% through passive deratement and offset blade rotation.

Jet Noise Experiments
Syracuse University, May 2012 to May 2014

- Began undergraduate research by quantifying high-speed jet noise through wavelet and statistical analysis under the guidance of Dr. Jacques Lewalle and Dr. Mark Glauser.
- Gained research experience and an appreciation for teamwork by working with graduate students through two summer research experiences.
- Each summer internship concluded with presentations at North East Regional AIAA Student Conference (2012, 2013) and a poster submission at the 67th APS DFD Meeting (2014).

Senior Design - Aerospace Engineering
Syracuse University, Sept 2013 to May 2014

Worked on a team of three students to design, build and operate a remote controlled aircraft able to complete a complex flight plan while carrying payload.

- Provided with a motor and two servos from a commercial model aircraft.
- Design of wing profile, fuselage, control surfaces and materials required experimental optimization.
- Final design provided a robust design for maximum payload, ease of navigation and interchangeable components to anticipate and overcome catastrophic failure.

Aerospace Structures Final Project
Syracuse University, Aug 2013 to Dec 2013

Learned the processes behind the design and modification of dynamic aerospace structures with an emphasis on high pressure loading and life cycles.

- Designed increasingly complex structures with both static and dynamic forcing
- Optimized complex non-uniform components to reduce cost and weight
- Final project focused on developing an optimal design for an airplane's main wing spar that would survive varied loading over thousands of flights without failure.

PUBLICATIONS

- G. A. Freedland, G. Eliason, S. A. Solovitz and R. B. Cal, (2020) "The role of turbulent inflow on the development of a round jet in cross-flow," *International Journal of Heat and Fluid Flow*, Vol 84, https://doi.org/10.1016/j.ijheatfluidflow.2020.108592
- J. S. McNeal, G. A. Freedland, L. G. Mastin, R. B. Cal and S. A. Solovitz, (2019) "Investigating the Accuracy of One-Dimensional Volcanic Plume Models using Laboratory Experiments and Field Data," *Journal of Geophysical Research: Solid Earth*, Vol 124(11), https://doi.org/10.1029/2018JB017224

CONFERENCE PRESENTATIONS

- 2019: G. A. Freedland, G. Eliason, S. A. Solovitz and R.B. Cal, "The Role of Turbulence on the Development and Entrainment of a Turbulent Jet in Cross-flow," 19th European Turbulence Conference, Torino, Italy, Sept, 2019.
- 2019: G. A. Freedland, G. Eliason, S. A. Solovitz and R.B. Cal, "The Role of Turbulence on the Development and Entrainment of a Turbulent Jet in Cross-flow," 72nd American Physical Society Division of Fluid Dynamics Meeting, Seattle, WA, Nov, 2019
- 2018: G. A. Freedland, L. G. Mastin, S. A. Solovitz and R.B. Cal, "Flow Development of Buoyant Round Jets in Cross-flow," 71st American Physical Society Division of Fluid Dynamics Meeting, Atlanta, GA, Nov, 2018
- 2017: G. A. Freedland, S. A. Solovitz, L. G. Mastin and R.B. Cal, "Entrainment and Production of Turbulence for a Round Jet in Cross-Flow," 70th American Physical Society Division of Fluid Dynamics, Denver, CO, Nov, 2017
- 2016: G. A. Freedland, L. G. Mastin, S. A. Solovitz and R.B. Cal, "Investigation of Jet Dynamics in Cross-Flow: Quantifying Volcanic Plume Behavior," 69th American Physical Society Division of Fluid Dynamics Meeting, Portland, OR, Nov, 2016
- 2016: E. Moore, G. A. Freedland, T. Dib, R. B. Cal, "Flow over a model boreal forest canopy and its dependence on canopy density," 69th American Physical Society Division of Fluid Dynamics Meeting, Portland, OR, Nov, 2016

TEACHING AND MENTORING EXPERIENCE

Portland State University
Teaching Assistant and Lecturer, Sept 2014 to Sept 2016, 2018

- Graduate Teaching Assistant (2018) for Thermodynamics (ME 321) and Applied Fluid Dynamics (ME 322).
- Graduate Teaching Assistant (2014-2016) for Introduction to Engineering (ME101 - ME103) and Introduction to Fluid Dynamics (ME320).

Oregon Museum of Science and Industry (OMSI)
Volunteer Science Communicator, 2019 to present

- Received the Science Communicator Training Fellowship Award in March 2019
- Volunteered at OMSI "Meet a Scientist" Events open to the community.
- Designed and fabricated an interactive display that focused on influence of wind on volcanic ash spread, by rolling balls of varying density down a ramp while being pushed by the wind.

TECHNICAL SKILLS

- **Project Management:** Learned through training and experience to develop timelines and goals for projects, maintain steady cadence of communication between relevant stakeholders, and deliver results by the agreed deadline.
- **Customer Communication:** Developed the ability to translate engineering specifications and design to both technical and non-technical contributors, managing customer relations on long term projects, and maintaining a network of experts to provide accurate information in a timely manner.
- **Metrology:** Proficiency in both the understanding and utilization of metrology concepts in both the lithography industry and experimental data collection (PIV).
- **Scripting and Data Analysis:** Ability to develop logic and write scripts to both streamline workflows and generate results from large data sets.
- **Fluid Dynamics/Turbulence:** Proficiency in fundamental turbulent theory to comprehensively describe phenomena in experimental data and applied fluid dynamic engineering design.
- **Experimental Design:** Successful design, manufacture, construction, and modification across a broad range of scenarios with the goal of accurate data collection.
- **Numerical Methods:** Theoretical advancement combining a variety of mathematical concepts including model reduction through proper orthogonal decomposition, critical point and topological degree analysis, statistics and probability, systems of equations, and signal processing.
- **Aeroacoustics:** Application of the wave-equation to model pressure fields in 2D/3D and utilization of wavelet analysis to correlate multiple acoustic signals.
- **Lab Technician/Supervisor:** Ability to master experimental equipment and communicate changes within a short time frame or deadline. Current experience includes closed loop wind tunnel operation, LaVision stereo particle image velocimetry setup, calibration and collection, and LabView data acquisition, operation and programming.

RELATED SKILLS

Software:

- LabView,
- Mathematica,
- Star CCM+ (CFD)
- DaVis products,
- SolidWorks,
- Autodesk Design Products
- (AutoCAD, 3DS Max, Rivet, etc.),
- SketchUp,
- Microsoft Office Products

Programming Languages:

- Matlab,
- Python,

References provided upon request.