# Lucas J. Stanek

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## Research Interests

Scientific computing, numerical analysis, computational plasma science, kinetic theory, molecular dynamics

## Education

**Michigan State University** **East Lansing, MI**
*PhD Computational Mathematics, Science and Engineering* *2017–Present*
**Advisor**: Dr. Michael Murillo
**Thesis Topic**: Hybrid Computational Method for Strongly-Coupled Plasmas

**The University of Akron** **Akron, OH**
*BS/MS Applied Mathematics (Magna Cum Laude)* *2012–2017*
**Advisors**: Dr. Malena Español, Dr. Dmitry Golovaty, Dr. J. Patrick Wilber
**Thesis Title**: *Deformation of a Graphene Sheet Driven by Lattice Mismatch with a Supporting Substrate*

## Projects

***Implicit Particle-In-Cell Method for Two Stream Instability*** *Spring 2018*
*Project Description*: A particle-in-cell code was written in Python to model the two stream instability that occurs in plasma physics. First, an explicit method was heavily optimized by writing the algorithm in such a way that the algorithmic complexity is minimized (10 times speedup) along with implementing state of the art Python optimization methods resulting in a 300 times speedup. The implementation of an implicit method and how it would further reduce the computation cost was discussed.

***Non-Equilibrium Molecular Dynamics: Shock Physics*** *Spring 2018*
*Project Description*: A molecular dynamics model was implemented to study the behavior of a shockwave as it traveled through a domain of particles representing solid argon. The shockwave was created via piston and the model reports measurables of the system including temperature, pressure, and particle density. State of the art optimization methods in Python were implemented to obtain speed up on the order of $10^3$. The visualization software, Ovito was used to visualize the dynamics of the system as it evolves through time.

***Eigenvalue problems for Sturm-Liouville Equations*** *Fall 2017*
*Project Description*: Numerical solutions to the 1D Sturm-Liouville spectrum problem were found by means of multiple eigenvalue solvers. The computational efficiency of each solver was studied and were then compared to the true solution to assess their order of convergence. A method was then designed to handle the generalized eigenvalue problem.

***Deformation of a Graphene Sheet Driven by Lattice Mismatch with a Supporting Substrate*** *Spring 2017*
*Project Description*: Deformation of a chain of bonded particles interacting with a chain of particles on a rigid substrate via van der Waals interactions was studied via simulation. An equilibrium configuration of the system given an initial condition was found by means of gradient flow dynamics. This energy-based model provided insight on out-of-plane deformations and connections were made to lattice-constants and model parameters governing the strength of the force terms.

## Research/Teaching Experience

### Michigan State University

*Graduate Research Assistant* *2018–Present*

*Research Assistant in Dr. Michael Murillo's Laboratory*

- Exploring the implementation of the two-temperature model to an ionic BGK equation. The goal is to provide dynamic electron properties and apply this idea to applications that consider interface mixing.
- Creating a hybrid molecular dynamics – hydrodynamics model to model strongly coupled plasmas. We hope to apply this method to applications such as inertial confinement fusion.

*Graduate Teaching Assistant* *2017–2018*

*Introduction to Computational Modeling Teaching Assistant (2 Semesters)*

- Instruct weekly classes that are structured according to the flipped classroom model related to scientific computing and programming
- Aid in the management of GitHub repository that is used for creating content in the form of pre-class, in-class, and homework assignments
- Grade all assignments and provide constructive feedback
- Run Python "bootcamp" that has the purpose of providing students who are struggling with basic programming concepts or specific topics discussed in class

### The University of Akron

*Running Start Summer Bridge Tutor/Mentor* *Summers 2015–2017*

- Mentored incoming freshmen in both math and general studies courses
- Directed study tables 5 days a week for approximately 20 students
- Designed supplemental material that motivated collaboration and targeted the core concepts in class
- Paired students of different skill levels to facilitate understanding and teamwork

*Graduate Teaching Assistant* *2015–2017*

*Precalculus Instructor of Record (2 Semesters)*

- Taught weekly classes over concepts in mathematics from Precalculus
- Created and grade weekly homework assignments, quizzes and exams
- Instructed students on use of McGraw Hill software
- Educated students struggling with course content during office hours in one-on-one and group settings
- Hosted review sessions outside of scheduled lectures in preparation for examinations
- Attended weekly meetings with coordinator to gain experience and promote success amongst students

*Algebra for Calculus Discussion Leader (2 Semesters)*

- Lead weekly classes to answer question review material taught in college algebra
- Prepared example problems that motivated group discussion and promoted deeper conceptual understanding
- Hosted review sessions for students seeking additional help
- Graded and proctored exams and quizzes

## Industry Experience

### National Interstate Insurance Co.

*Workers' Compensation Claims Analyst Intern* *Summer 2016*

- Responsible for management of medical databases for analysis on workers' compensation claims
- Cleaned and organized data into a workable subset for statistical analysis
- Analyzed medical data using multivariate regression methods along with statistical analysis software
- Created a predictive model to analyze medical data and forecast potential losses of capital
- Presented results to members of leadership across different departments to motivate future work
- Collaborated with a group of interns to present a research topic to the operations committee

## Organizations and Affiliations

CMSE Graduate Student Organization: President *2017–Present*
CMSE Graduate/Faculty Student Intramural Soccer Team: Member *2017–Present*
Society of Industrial and Applied Mathematics: Member *2015–Present*

## Honors and Awards

Raymond P. and Marie M. Ginther Graduate Fellowship Recipient: Michigan State University *2017–2020*
Choose Ohio First STEM Scholarship Recipient: The University of Akron *2014–2017*

## References

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