

# Andrew M. Chap

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Code, media, and presentation samples:  
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## Education

- **Ph.D., Aerospace Engineering** November 2017  
**M.S., Aerospace Engineering** May 2015  
University of Maryland, College Park, MD GPA: 3.92
- **B.A., Physics** May 2006  
College of the Holy Cross, Worcester, MA GPA: 3.56

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## Programming and Analysis Skills

*Thorough experience with* C, Python, Bash, CUDA, MATLAB/MEX, L<sup>A</sup>T<sub>E</sub>X/PGF/TikZ, reveal.js, NumPy, Matplotlib, Linux/Vim/Tmux/SVN development environment, High performance computing  
*Moderate experience with* C++, C#, Julia, Pandas, SciPy, Plotly, TensorFlow, AWS, HTML/CSS, GitHub  
*Familiarity with* CMake, OpenMP, VTK/ParaView, Visual Studio

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## Relevant Experience

### Tech-X Corporation

Associate Research Scientist

Boulder, CO

December 2017 - Present

- Improved the algorithm for the speed-limited particle-in-cell (SLPIC) method and modified the C++ source code, resulting in an increase of SLPIC speed-up for our test problem from 160× to 260× while also decreasing error.
- Simplified the process of accepting new test results in Tech-X's CMake/Python automated testing framework, by implementing automatic plotting of failed tests on Linux/Mac/Windows and by working with the QA team to have these plots saved as build artifacts for easy access to developers.
- Delivered an internal presentation on creating interactive/web-friendly/engaging presentations with reveal.js and provided a company-themed template for co-workers to use for their conference presentations.
- Created a framework for repeatable testing of computational performance and memory usage to compare old and new simulations over hundreds of test problems, using Bash/Pandas.
- Developed an algorithm using Python/NumPy/SciPy to detect steady-state in a simulation using a combination of *t*-tests and *f*-tests between temporally delineated data windows.

### Personal/hobby Projects

- Designed a neural network on AWS to predict the output of a discontinuous function of two variables with Python/NumPy and then translated it into TensorFlow.
- Created a minimal computer game using Unity3D and C#.

### Space Power and Propulsion Laboratory

Graduate Research Assistant

University of Maryland

January 2012 - November 2017

- Developed multiple simulations for inertial electrostatic confinement fusion in order to enhance the understanding of the physics of the device and to perform optimization of the device parameters.
- Applied parameter-sweep automation of simulations on a GPU as well as on Deepthought2 (University of Maryland computing cluster) to accelerate computation.
- Created a new heuristic model for Coulomb collisions using large sets of GPU-generated data, published in APS Physical Review.
- Translated serial MATLAB code into C and parallel CUDA code resulting in a 150× speedup.

- Generated 3D visualizations/animations to effectively communicate device geometry and plasma behavior.
- Trained undergraduate research assistants and, as the *de facto* in-house simulation expert, assisted fellow graduate students with their simulation codes and visualizations.

### **Eagleworks Laboratory**

NASA Space Technology Research Fellow

NASA Johnson Space Center, Houston, TX

July-November 2015

- Revamped existing particle simulation code by replacing inefficient and inaccurate code with improved code, validated the correct physics of each component, and translated C code into **CUDA** resulting in a 21× speedup.
- Analyzed simulation assumptions and introduced additional physics into model as necessary for correct results.
- Used simulation to make predictions on thruster performance which agreed well with experimental results: simulation now exists as a tool to characterize full-scale performance.

### **EP6 Traveling Wave Direct Energy Converter Project**

NASA Space Technology Research Fellow

NASA Johnson Space Center, Houston, TX

January-July 2013, July-September 2014

- Designed and operated a high-voltage 2 kHz switch for ion beam modulation inside a vacuum chamber.
- Designed, calibrated, and operated an ion current probe with oscilloscope and a magnetic sensor probe to profile ion beam and make design recommendations for a second-generation experiment.
- Developed a simulation coupling plasma kinetics with electronics resulting in the definition of optimal operating parameters.

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## **Patent**

- Sedwick, R. J., Chap, A. M., Continuous Electrode Inertial Electrostatic Confinement Fusion, US Provisional Patent Application 62/367,410, July 27, 2016

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## **Publications**

### **Peer-reviewed**

- Chap, A. M., Sedwick, R. J., Coulomb collision model for use in non-thermal plasma simulation, *Phys. Rev. E* **95:6 063209** (2017)
- Chap, A. M., Sedwick, R. J., One-Dimensional Semianalytical Model for Optimizing the Standing-Wave Direct Energy Converter, *Journal of Propulsion and Power* **31:5 1350-1361** (2015)

### **Ph.D. Thesis**

- Chap, A. M., Simulation and Optimization of an Inertial Electrostatic Confinement Fusor *University of Maryland* (2017)

### **Conference Papers**

- Chap, A. M., Sedwick, R. J., Simulation and Optimization of the Continuous Grid Inertial Electrostatic Confinement Fusion Device, *53rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference* 2017-4678 (2017)
- Chap, A. M., Sedwick, R. J., Inertial Electrostatic Confinement Fusion Simulation and a Statistical Treatment of Coulomb Collisions, *51st AIAA/ASME/SAE/ASEE Joint Propulsion Conference*, AIAA 2016-4776 (2016)
- Chap, A. M., Sedwick, R. J., Simulation of an Inertial Electrostatic Confinement Device Using a Hermite N-body Individual Time-step Scheme, *51st AIAA/ASME/SAE/ASEE Joint Propulsion Conference*, AIAA 2015-3860 (2015)
- Chap, A. M., Sedwick, R. J., A Hybrid Particle-in-cell Simulation for a Multiple Grid Magnetic Core Inertial Electrostatic Confinement Device, *50th AIAA/ASME/SAE/ASEE Joint Propulsion Conference*, AIAA 2014-3516 (2014)
- Chap, A. M., Tarditi, A.G., Sedwick, R. J., Numerical and Experimental Investigation on the Traveling Wave Direct Energy Converter Concept, *50th AIAA/ASME/SAE/ASEE Joint Propulsion Conference*, AIAA 2014-3559 (2014)
- Chap, A. M., Tarditi, A.G., Scott, J.H., A Particle-in-cell Simulation for the Traveling Wave Direct Energy Converter (TWDEC) for Fusion Propulsion, *49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference*, AIAA 2013-3912 (2013)
- Tarditi, A.G., Chap, A.M., Wolinsky, J., Scott, J.H., Progress towards the Development of a Traveling Wave Direct Energy Converter for Aneutronic Fusion Propulsion Applications, *51st AIAA/ASME/SAE/ASEE Joint Propulsion Conference*, AIAA 2015-3861 (2015)