Andrew M. Chap

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PROJECT leader and equal parts aerospace engineer & software engineer. • Passionate about software architecture with OOP design and AI-assisted code development. • Author of algorithms currently flying on satellites. • Effective communicator with a love for data visualization in Python and MATLAB. • Plasma physics background with experience in parallel programming. • Team-builder who enjoys concocting coding questions and conducting interviews.

Ph.D., Aerospace Engineering — 2017
University of Maryland, College Park, MD — GPA 3.92

B.A., Physics — 2006
College of the Holy Cross, Worcester, MA — GPA 3.56

Technical Skills

C++, Python (NumPy, SciPy, Pandas, Plotly, Dash etc.)
MATLAB, CUDA, Bash, PowerShell, Git, Jira
VS Code, Vim, HPC/Cloud computing, ChatGPT-o1, LaTeX, HTML/CSS
Kalman filters, quaternions, global optimization, Monte Carlo, orbital dynamics, structural dynamics, electromagnetics, plasma physics, & beamforming

✱ *Comfortable with remote/in-office/hybrid work*
✱ *Willing to travel as needed*

Relevant Experience

AST SpaceMobile — *Lanham, MD, hybrid remote*
Principal Simulation Engineer — June 2023 - Present
Senior Simulation Engineer — April 2020 - June 2023

- Manager and chief author of the differential GPS algorithm (C++ flight code) using phase measurements of GPS signals to estimate satellite deformation & misalignment of the antenna array, used to enhance cell phone connectivity operations on AST's BlueBird satellites
- Concurrently tasked up to 4 team members in: algorithm development, parameter optimization, flight software integration, hardware R&D & testing, flight operations coordination, and flight telemetry downloads
- Responsible for numerous bugfixes and enhancements across multiple teams' flight code, including in Kalman filters, quaternion computations, orbital dynamics, and beamforming, for all AST satellites
- Developed pre-launch hardware-in-the-loop automated test for the differential GPS algorithm on Blue-Walker 3: MATLAB-simulation → GPS RF signal generator → GPS receiver → binary port reader → differential GPS algorithm (flight code) → results validation & visualization.
- Developed the directional antenna-pointing table-generation (ground ops) and on-board antenna correction algorithm (space ops), both currently in use for BlueWalker 3.
- Created a comprehensive MATLAB+SSH launcher/visualizer for AST's C++/Docker software-in-the-loop sim
  - ✱ Used by multiple teams (flight software, controls, payload) enabling parameterizable/repeatable testing with intuitive visualization of simulation environment and
  - ✱ Deployed an automated regression tester that sends alerts and summaries to a Microsoft Teams channel

Tech-X Corporation — *Boulder, CO*
Associate Research Scientist — Dec 2017 - July 2019

- Invented a new algorithm for correctly populating particles governed by space-charge-limited emission in particle-in-cell simulation ([publication](#)) ([presentation](#))
- Improved the speed-limited particle-in-cell algorithm in Tech-X's VSim software, resulting in a $1.5\times$ speed increase and a 75% decrease in error for the relevant canonical test problem.
- Implemented automatic plotting and production of artifacts for failed tests on the Jenkins CI/CD pipeline and created reports on computation time and memory usage for each test.

Maxar Technologies   *Westminster, CO*
Site Reliability Engineer   July 2019 - April 2020

- Operated and customized Nimsoft Infrastructure Manager to monitor production servers; developed Bash scripts for custom alarm triggers, participated in on-call shifts handling alerts, and analyzed historical alarm patterns to aid root-cause analysis.
- Automated the process of creating organizational AWS commercial/GovCloud accounts with IAM roles tied to security groups; added logging & fault recovery features and handed off code module to ops team

UMD Space Power and Propulsion Laboratory   *University of Maryland*
Graduate Research Assistant, Inertial Electrostatic Confinement (IEC) Fusion   Jan 2012 - Dec 2017

- Conceptualized the truncated icosahedron continuous-electrode IEC with permanent magnets (video). For analysis developed multiple independent magneto/electrostatic plasma simulations in MATLAB, including:
  - ∗ An N-body discrete-event simulation to study electron/ion dynamics in complex 3D geometry (video)
  - ∗ A 2D3V axisymmetric particle-in-cell simulation for fast simulation using an axisymmetric assumption. Translated bottlenecks into C and CUDA, resulting in a $150\times$ speedup when run on a GPU (video)
- Developed simulations with MATLAB GPU computing to generate large sets of data to develop a new heuristic model of Coulomb collisions for use in particle-in-cell simulations published in APS Physical Review.

NASA Johnson Space Center   *Houston, TX*
Graduate Intern / NASA Space Technology Research Fellow   Jan–Jul 2013, Jul–Sep 2014, Jul–Nov 2015

- Designed, calibrated, and operated an ion current probe and high-voltage 2 kHz switch with an oscilloscope and a magnetic sensor probe to profile a charged-particle beam and make design recommendations.
- Developed a 2D3V axisymmetric particle-in-cell simulation of the traveling-wave direct energy converter, providing estimates on power generation, and determined that next-gen experiments would require significantly higher magnetic containment fields to produce meaningful results (video)

Personal / Hobby Projects
- Created a mortgage analysis Python module that uses time-value-of-money calculations, with a Dash (Python) web application frontend deployed on Google App Engine.
- Creator of the num2tex and symdim Python modules.

Publication Summary

- Coulomb collision model for use in non-thermal plasma simulation
  Chap, A. M., Sedwick, R. J., *Physical Review E* **95**:6 063209 (2017)

- One-Dimensional Semianalytical Model for Optimizing the Standing-Wave Direct Energy Converter
  Chap, A. M., Sedwick, R. J., *Journal of Propulsion and Power* **31**:5 1350–1361 (2015)

- A new simple algorithm for space charge limited emission
  Stoltz, P., Luginsland, J., Chap, A. M., Smithe, D. N., Cary, J. R., *Physics of Plasmas* **27**:9 (2020)

- Speeding up simulations by slowing down particles: Speed-limited particle-in-cell simulation
  Werner, G. R., Jenkins, T. G., Chap, A. M., Cary, J. R., *Physics of Plasmas* **25**:12 123512 (2018)

- Accelerated steady-state electrostatic particle-in-cell simulation of Langmuir probes
  Werner, G. R., Robertson, S., Jenkins, T. G., Chap, A. M., Cary, J. R., *Physics of Plasmas* **29**:1 (2022)

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

- Systems, Methods, and Devices for Inertial Electrostatic Confinements
  Sedwick, R. J., Chap, A. M., US Provisional Patent Application 62/367,410 (2016)