Andrew M. Chap

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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

Programming and Analysis Skills

Python, C++, Matlab, Git, CUDA, Bash, PowerShell, Dash/Plotly, AWS, Google Cloud Platform, VS Code, Vim, LaTeX/Ti*k*Z

Proficient in object-oriented principles for algorithm design and testing, for the benefits of automation, maintenance, repeatability, readability, and data analysis & visualization.

Relevant Experience

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

- Owner of the differential GPS algorithm using phase measurements of GPS signals to estimate deformation & misalignment of the antenna array, as required for phase compensation during beamforming operations.
- Current leader/tasker of 2-3 team members for differential GPS, in the categories of algorithm development, parallelization & optimization, and C++ software-in-the-loop integration & testing.
- Developed hardware-in-the-loop pre-launch testing for the differential GPS algorithm on Bluewalker 3, including the completely automated process of: Matlab-simulation → GPS RF signal generator → GPS receiver → Matlab serial port reader → differential GPS algorithm → data visualization.
- Developed the antenna-pointing table generation (ground ops) and on-board antenna correction algorithm (space ops) both of which are currently in-use on Bluewalker 3.
- Created a complex Matlab interface for launching company's software-in-the-loop simulator on EC2s over SSH to enable parameterizable/repeatable testing and automation of live data visualization during simulator runs, currently used by the flight software and attitude/controls teams. Created a Matlab regression testing framework to continuously run a suite of tests on the latest code revision and send summaries and failure alerts to a Microsoft Teams channel. The visualization tools developed during this project are also used in development of the differential GPS algorithm.

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

- Invented a new algorithm for correctly populating particles governed by space-charge-limited emission in particle-in-cell simulation, published in AIP Physics of Plasmas.
- Improved the algorithm for the speed-limited particle-in-cell method and modified the C++ source code, resulting in a $1.5\times$ speed increase and a 75% decrease in error for the relevant canonical test problem.
- Implemented automatic plotting of failed tests on the Jenkins CI/CD pipeline and created reports on computation time and memory usage for each test.

Maxar Technologies
Site Reliability Engineer

Westminster, CO
July 2019 - April 2020

- Built a "Maxar Acronyms and Info" Slack bot, with commands for users to query, add, and modify entries via Slack messages. Built via an AWS Lambda function and a custom Python module with ElastiCache for quick storage & retrieval. Available company-wide, and especially valuable for new employees.

- Automated the process for creating organizational AWS commercial/GovCloud accounts with IAM roles tied to security groups. Added logging and fault recovery features, and handed off to the operations team.

Space Power and Propulsion Laboratory
Graduate Research Assistant

University of Maryland
January 2012 - December 2017

- Conceptualized (with Ph.D. advisor) the truncated icosahedron continuous-electrode IEC with permanent magnets along channel walls for simultaneous electron/ion confinement, developed simulations of 3D geometry and E&M fields, developed 2D3V axisymmetric particle-in-cell simulation of a single channel, developed fully-3D N-body discrete-event simulation for full electron/ion dynamics.

- Translated serial MATLAB simulation code into C and parallel CUDA code resulting in a $150\times$ speedup of 2D3V axisymmetric particle-in-cell code.

- Developed optimization routine to maximize simulated fusion power by adjusting voltages on channel walls.

- Used GPU computing to generate large sets of numerical experiment data as a basis for creating a new heuristic model for Coulomb collisions, published in APS Physical Review.

NASA Johnson Space Center
Graduate Intern/NASA Space Technology Research Fellow

Houston, TX
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 travelling-wave direct energy converter experiment, providing estimates on experimental and theoretical power generation.

Personal/hobby Projects

- Created a mortgage analysis Python module that uses the time-value of money to calculate long-term valuation of loans and investments. Created a Dash/Plotly/CSS web application front-end using Google App Engine, for users generate plots without needing to directly interact with code.

- Creator of the num2tex and symdim Python modules.

Selected Publications

- Chap, A. M., Sedwick, R. J., Coulomb collision model for use in non-thermal plasma simulation, *Physical Review 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)

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

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

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

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

- [Patent] Sedwick, R. J., Chap, A. M., Systems, Methods, and Devices for Inertial Electrostatic Confinements US Provisional Patent Application 62/367,410, July 27, 2016