Joseph C. Ferguson

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Education

Stanford University **Stanford, CA**
PhD – Mechanical Engineering *Sep 2018 – Current*
MSc – Mechanical Engineering, Fluid Mechanics depth *Sep 2018 – June 2020*

University of Kentucky **Lexington, KY**
Bachelor of Science – Mechanical Engineering *Aug 2011 – Jun 2016*

Professional Experience

NASA Ames Research Center, Advanced Supercomputing Division **Mountain View, CA**
Junior Research Scientist - Science and Technology Corp. ***June 2016 – Sep 2019***
Research Associate - Education Associates Program *January 2014 – Aug 2015*

- Lead developer for the Porous Microstructure Analysis (PuMA) software, available as a NASA software under a US & Foreign release.
- Responsibilities include physical model development, software development, publishing and presenting on research, and use of software to support NASA missions.

LongShot Space Technology Corporation **Alameda, CA**
Science Advisor *April 2020 - Present*

- Provide technical analysis and advice on the development of a multi-stage light gas gun for hypersonic testing and (eventually) kinetic space launch.

University of Kentucky, Dept. of Mechanical Engineering **Lexington, KY**
Undergraduate Research Assistant *June 2012 – May 2015*

- Conducted research in the Gas Surface Interactions lab on aerothermal modeling for Earth and Mars atmospheres during spacecraft entry conditions.

NASA Goddard Space Flight Center **Greenbelt, MD**
Software Engineering Intern *January 2013 – May 2013*

- Worked as a software development intern for GMSEC, a software platform used for satellite communication systems. Helped to develop GRASP, a platform for remote, secure access to satellite data.

University of Kentucky, Dept. of Entomology **Lexington, KY**
Research Assistant *June 2009 – May 2011*

- Conducted independent research on the use of RNAi as a pesticide in the Colorado Potato Beetle.
- Presented research at the 2010 and 2011 Intel International Science and Engineering Fairs.

Software Releases

Porous Microstructure Analysis (PuMA) **software.nasa.gov/software/ARC-17920-1A**
Lead Developer *2017 (Us & Foreign), 2021 (Open Source)*

Software Description: the Porous Microstructure Analysis (PuMA) software has been developed in order to compute effective material properties and perform material response simulations on digitized microstructures of porous media. Version 3.1 includes modules to compute porosity, volume fractions, surface area, tortuosity factor, effective thermal conductivity, effective electrical conductivity, representative elementary volume and time-dependent diffusion-reaction.

PuMA Source Code: github.com/nasa/puma
PuMA Documentation: puma-nasa.readthedocs.io/en/latest/
PuMA Tutorial Videos: youtube.com/channel/UCBp_QC6ctwzdyxfZn7uHj0w/videos
PuMA Community Forum: gitter.im/puma-nasa/

Publications

- Joseph C. Ferguson, Arnaud Borner, Francesco Panerai, Sigrid Close, Nagi N Mansour. "Continuum to rarefied diffusive tortuosity factors in porous media from X-ray microtomography" Computational Materials Science (2021)

- Joseph C. Ferguson, Federico Semeraro, John M. Thornton, Francesco Panerai, Arnaud Borner, Nagi N Mansour. "Update 3.0 to PuMA: The Porous Microstructure Analysis software" SoftwareX (2021)

- Joseph C. Ferguson, Sadaf Sobhani, Matthias Ihme. "Pore-resolved simulations of porous media combustion with conjugate heat transfer" Proceedings of the Combustion Institute (2021)

- Joseph C. Ferguson, Francesco Panerai, Arnaud Borner, Nagi N Mansour. "PuMA: The Porous Microstructure Analysis software" SoftwareX (2018)

- Joseph C. Ferguson, Francesco Panerai, Jean Lachaud, Nagi N Mansour. "Theoretical Study on the micro-scale oxidation of resin-infused carbon ablators" Carbon Vol. 121 (2017)

- Joseph C. Ferguson, Francesco Panerai, Jean Lachaud, Alexandre Martin, Sean CC Bailey, Nagi N Mansour. "Modeling the oxidation of low-density carbon fiber material based on micro-tomography" Carbon Vol. 96 (2016)

- Kaan Kirmanoglu, Nicholas Anderson, Francesco Panerai, Kelly Stephani, Joseph Ferguson, Sigrid Close. "Simulating Oxidation of Carbon Surfaces by Atomic Oxygen Coupled with a Finite Rate Oxidation Model" AIAA SciTech (2022)

- Federico Semeraro, Joseph C. Ferguson, Francesco Panerai, Robert King, Nagi N. Mansour. "Anisotropic analysis of fibrous and woven materials. Part 1: Estimation of local orientation" Computational Materials Science (2020)

- Federico Semeraro, Joseph C. Ferguson, Marcos Acin, Francesco Panerai, Nagi N. Mansour. "Anisotropic analysis of fibrous and woven materials. Part 2: Computation of effective conductivity" Computational Materials Science (2020)

- Francesco Panerai, Joseph C. Ferguson, Jean Lachaud, Alexandre Martin, Matthew J Gasch, Nagi N Mansour. "Micro-tomography based analysis of thermal conductivity, diffusivity and oxidation behavior of rigid and flexible fibrous insulators" International Journal of Heat and Mass Transfer (2017)

- Francesco Panerai, Joseph Ferguson, Jean Lachaud, Alexandre Martin, Matthew J Gasch, Nagi N Mansour. "Analysis of fibrous felts for flexible ablators using synchrotron hard x-ray micro-tomography" 8th European Symposium on Aerothermodynamics for Space Vehicles (2015)

- Revathi Jambunathan, Deborah A Levin, Arnaud Borner, Joseph C Ferguson, Francesco Panerai. "Prediction of gas transport properties through fibrous carbon preform microstructures using Direct Simulation Monte Carlo" International Journal of Heat and Mass Transfer (2019)

- Joseph C. Ferguson, Francesco Panerai, Nagi N Mansour. "PuMA V2.1 Documentation and User Manual" NASA Technical Memorandum (2017)

- Fang Zhu, Jingjing Xu, Roshan Palli, Joseph Ferguson, Subba R Palli. "Ingested RNA interference for managing the populations of the Colorado potato beetle, Leptinotarsa decemlineata" Pest Management Science (2011)

Conference Talks and Seminars

- "Pore-resolved simulations of porous media combustion with conjugate heat transfer" 38th International Symposium on Combustion. Adelaide, Australia. 2021

- "The Porous Materials Analysis open-source software for material properties and response based on micro-tomography" International Conference on the Tomography of Materials and Structures. Lund, Sweden. 2017

- "X-ray micro-tomography for advanced material technologies: a NASA perspective" Space Tech Expo. Pasadena, CA. 2017

- "Particle methods for diffusivity and tortuosity of porous media" Ablation Workshop. Boseman, MT. 2017

- "Porous Materials Analysis (PuMA): A computational framework for micro-tomography material properties and response" Ablation Workshop. Tuscon, AZ. 2016

- "From microtomography to modeling of the fiber-scale oxidation of highly-porous carbon materials" Advanced Modeling & Simulation (AMS) Seminar Series. Moffett Field, CA. 2014

Awards

- NASA Early Career Public Achievement Medal, 2019. "For exceptional engineering achievement in developing the Porous Microstructure Analysis (PuMA) software for micro-scale thermal protection material response."
- NASA Group Achievement Award, 2017. ESM Micro-Scale TPS Modeling Team. "For exceptional engineering achievement in developing revolutionary capability for predictive modeling of TPS performance from first principles."
- Main belt asteroid, JoCorbFerg (26411), named in my honor at Intel International Science and Engineering Fair, 2010
- Patterson Scholarship Recipient, University of Kentucky, 2011
- National Merit Scholar, 2010

Grants

- NASA Space Technology Research Fellowship (NSTRF), 2019 - 2023
- NASA Kentucky EPSCoR Space Grant Recipient, 2014
- NASA Kentucky EPSCoR Space Grant Recipient, 2013

Professional Certifications

- Private Pilot's License, 2013 - present