# Daoru (Frank) Han

Assistant Professor of Aerospace Engineering
Department of Mechanical and Aerospace Engineering
Missouri University of Science and Technology (MST), Rolla, MO 65409
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## Personal Details

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| *Address* | 131 Toomey Hall<br>Department of Mechanical and Aerospace Engineering<br>Missouri University of Science and Technology<br>400 W. 13th St<br>Rolla, MO 65409-0050 |
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## Education

**Ph.D., Astronautical Engineering** 2011-2015
*University of Southern California (USC)*
*Los Angeles, CA, USA*
Dissertation: *Particle-in-Cell Simulations of Plasma Interactions with Asteroidal and Lunar Surfaces*
Advisor: Prof. Joseph J. Wang

**M.S., Aerospace Engineering** 2009-2011
*Missouri University of Science and Technology (Missouri S&T, Formerly University of Missouri - Rolla)*
*Rolla, MO, USA*
Thesis: *Inherent and Model-Form Uncertainty Analysis for CFD Simulation of Synthetic Jet Actuators*
Advisor: Prof. Serhat Hosder

**B.Eng., Aeronautical Propulsion** 2005-2009
*Nanjing University of Aeronautics and Astronautics (NUAA)*
*Nanjing, China*
Thesis: *Effect of Dynamic Angle-of-Attack on the Internal Characteristics of a 2-D Hypersonic Inlet*
Advisor: Prof. Kunyuan Zhang

## Appointments

**Assistant Professor** 2017 -
*Department of Mechanical and Aerospace Engineering, Missouri S&T*
Director, Gas and Plasma Dynamics Laboratory
Director, Computational Fluid and Plasma Dynamics Laboratory
**Assistant Research Professor** 2016 - 2017
*Computational Fluid & Plasma Dynamics Laboratory, Aerospace Engineering Program, WPI*

**Resource Employee and Lecturer** 2015 - 2016
*Department of Astronautical Engineering, USC*

## Research Interests

Fluid/Gas/Plasma Dynamics
Plasma-Material Interactions
Space Environment
Space Propulsion
Computational Plasma Physics
High-Performance Computing

## Research Experience

**Assistant Professor** 2017 -
*Department of Mechanical and Aerospace Engineering, Missouri S&T*
- Computational Gas and Plasma Dynamics

**Assistant Research Professor** 2016 - 2017
*Computational Fluid & Plasma Dynamics Laboratory, Aerospace Engineering Program, WPI*
- Multi-scale gas and plasma modeling

**Postdoctoral Scholar** 2015 - 2016
*Laboratory for Astronautical Physics and Design, Department of Astronautical Engineering, USC*
- A 3-D parallel IFE-PIC framework for simulations of plasma dynamics with astronautical applications

**Research Assistant** 2011 - 2015
*Laboratory for Astronautical Plasma Dynamics, Department of Astronautical Engineering, USC*
- Particle-in-cell (PIC) modeling of space plasma interactions (Ph.D. dissertation)
- Immersed finite element (IFE) method
- Ion propulsion plume contamination
- Ion thruster grid erosion and ion optics
- Plasma environment at the lunar terminator
- Parallel programming/computing
- Mentor of one undergraduate student
- System administrator of computing facilities in the lab

**Research Assistant** 2009 - 2011
*Computational Fluid Dynamics and Aerospace Design Laboratory, Department of Mechanical and Aerospace Engineering, Missouri S&T*
- Inherent and epistemic uncertainty analysis of CFD modeling (M.S. thesis)
- CFD (URANS) modeling of synthetic jet actuators
- Non-Intrusive Polynomial Chaos (NIPC) for uncertainty quantification (UQ)

## Honors & Awards

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| *2019* | LEAG Bernard Ray Hawke Next Lunar Generation Career Development Award<br>Sponsored by NASA-SSERVI, $1,500<br>Travel award to 2019 Annual Meeting of the Lunar Exploration Analysis Group |
| *2015* | Best Teaching Assistant (2014-2015 Academic Year)<br>Viterbi School of Engineering, USC |
| *2014* | 2014 Doctoral Student Fall Grant Writing Workshop (Certificate of Completion)<br>Graduate School, USC |

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| *2014* | Best Research Assistant (2013-2014 Academic Year)<br>Viterbi School of Engineering, USC |
| *2014* | 2014 Doctoral Student Spring Seminars & Presentations (Certificate of Completion)<br>Graduate School, USC |
| *2013* | Myronis Endowed Fellowship (2013-2014 Academic Year)<br>Graduate School, USC |
| *2009* | Mathews Department Fellowship (Fall 2009 Semester)<br>Department of Mechanical and Aerospace Engineering, Missouri S & T |

## Publications (Journal Articles, accepted/published)

(Corresponding author, * students advised at MST)

12. Xinpeng Wei*, **Daoru Han**, and Xiaoping Du. **Predicting Average Product Lifetime Using Physics-Based Gaussian Process Method in A Design Stage**. *Journal of Computing and Information Science in Engineering*, 2021 (accepted)

11. Xinpeng Wei*, Jianxun Zhao*, Xiaoming He, Zhen Hu, Xiaoping Du, and **Daoru Han**. **Adaptive Kriging Method for Uncertainty Quantification of the Photoelectron Sheath and Dust Levitation on the Lunar Surface**. *ASME Journal of Verification, Validation and Uncertainty Quantification*, 2021 (accepted)

10. Xinpeng Wei*, **Daoru Han**, and Xiaoping Du. **Approximation to Multivariate Normal Integral and Its Application in Time-Dependent Reliability Analysis**. *Structural Safety*, 88:102008, January 2021. doi:10.1016/j.strusafe.2020.102008

9. **Daoru Han** and Joseph Wang. **3-D Fully-Kinetic Particle-in-Cell Simulations of Small Asteroid Charging in the Solar Wind**. *IEEE Transactions on Plasma Science*, 47(8):3682–3688, August 2019. doi:10.1109/TPS.2019.2919895

8. William Yu, **Daoru Han**, and Joseph Wang. **Numerical Simulations of Dust Dynamics Around Small Asteroids**. *IEEE Transactions on Plasma Science*, 47(8):3724–3730, August 2019. doi:10.1109/TPS.2019.2920263

7. **Daoru Han**, Joseph Wang, and Xiaoming He. **Immersed Finite Element Particle-in-Cell Simulations of Plasma Charging at the Lunar Terminator**. *Journal of Spacecraft and Rockets*, 55(6):1490–1497, November-December 2018. doi:10.2514/1.A34002

========== Arrival at MST ==========

6. Yuchuan Chu, **Daoru Han**, Yong Cao, Xiaoming He, and Joseph Wang. **An Immersed-Finite-Element Particle-in-Cell Simulation Tool for Plasma Surface Interaction**. *International Journal of Numerical Analysis and Modeling*, 14(2):175–200, 2017

5. **Daoru Han**, Pu Wang, Xiaoming He, Tao Lin, and Joseph Wang. **A 3D immersed finite element method with non-homogeneous interface flux jump for applications in particle-in-cell simulations of plasma-lunar surface interactions**. *Journal of Computational Physics*, 321:965–980, September 2016. doi:10.1016/j.jcp.2016.05.057

4. **Daoru Han**, Joseph Wang, and Xiaoming He. **A Nonhomogeneous Immersed-Finite-Element Particle-in-Cell Method for Modeling Dielectric Surface Charging in Plasmas**. *IEEE Transactions on Plasma Science*, 44(8):1326–1332, August 2016. doi:10.1109/TPS.2016.2580698

3. Joseph Wang, **Daoru Han**, and Yuan Hu. **Kinetic Simulations of Plasma Plume Potential in a Vacuum Chamber**. *IEEE Transactions on Plasma Science*, 43(9):3047–3053, September 2015. doi:10.1109/TPS.2015.2457912

2. **Daoru Han** and Serhat Hosder. **Inherent and Epistemic Uncertainty Analysis for Computational Fluid Dynamics Simulations of Synthetic Jet Actuators** . *International Journal for Uncertainty Quantification*, 4(6):511–533, 2014. doi:10.1615/Int.J.UncertaintyQuantification.2014010659

1. Srikanth Adya, **Daoru Han**, and Serhat Hosder. **Uncertainty Quantification Integrated to CFD Modeling of Synthetic Jet Actuators**. *International Journal of Flow Control*, 2(3):169–181, September 2010. doi:10.1260/1756-8250.2.3.169

## Computer Skills

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| *Basic* | Linux (RedHat/CentOS/Fedora/Debian/Ubuntu), Microsoft Windows, Mac |
| *Intermediate* | LaTeX, UG, SolidWorks, ANSYS/FLUENT, Tecplot, ParaView |
| *Advanced* | FORTRAN, C/C++, MATLAB, *OpenMP/pthreads*, *MPI*, *OpenACC/CUDA* |

## Professional Affiliations

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| *Senior Member* | American Institute of Aeronautics and Astronautics (AIAA) |
| *Member* | American Society of Mechanical Engineers (ASME) |
| *Member* | Institute of Electrical and Electronics Engineers (IEEE) |
| *Member (Level 3)* | Structural Extreme Events Reconnaissance (StEER) Network |