XUXIAO LI

LinkedIn: https://www.linkedin.com/in/xuxiaoli1993
Personal Website: https://xuxiaoli-1993.github.io
xuxiaoli.utah@gmail.com
8012096239

Ph.D. with 5 years' experience in physics-based modeling and computation

- Expertise in computational fluid dynamics (CFD), heat transfer, and material science.
- Experienced with maintaining, developing, and validating large scientific code.
- Collaborated with physicists and metrologists, coauthored 6 journal articles.

EDUCATION

University of Utah — Salt Lake City, Utah, USA
Ph.D., Mechanical Engineering — May 2021
M.S., Mechanical Engineering — May 2019
Area of Focus: thermal-fluid and metallurgical modeling for laser-based manufacturing.
Coursework: Thermodynamics, Finite Elements, Machine Learning.

Tongji University — Shanghai, China
B.S., Aircraft Manufacturing Engineering (solid and structural mechanics) — June 2015

TECHNICAL SKILLS

Fortran	Matlab	Linux	MPI	COMSOL	Git	SLURM
C/C++	Python	Tecplot	OpenMP	Abaqus	Latex	Gmsh

RESEARCH EXPERIENCE

CFD Software Development — Nov. 2016 – Present

- Maintaining a proprietary CFD software (in Fortran, over 25000 lines) for turbulent reacting flow, featuring the finite volume method, unstructured mesh, and MPI parallelization.
- Developed 5 new modules (level-set and finite-difference method, over 15000 lines) to grow capabilities for multiphase flow, free-surface tracking, and fluid-structure interaction.
- Identified and solved numerical issues such as boundary condition definition, the discretization accuracy, and parallel communication bottlenecks.
- Conducted systematic benchmarking with over 15 test problems. Wrote documentation and trained lab members to use the code for different applications.

Transient Dynamics in Laser Welding — Nov. 2018 – Oct. 2020

- Developed a multiphysics model that simulates the laser-metal interaction, melting and evaporation, molten pool flow, and gas dynamics in laser welding.
- Coordinated with physicists and metrologists to quantitatively compare the simulation with X-ray imaging data. Improved the model after analyzing the discrepancies.
- Quantified the thermal field and fluid dynamics to understand the pore (defect) formation. Provided design guidance (e.g., optimizing process parameters) to mitigate defects.

Powder-gas Interaction in Laser Powder Bed Fusion — Sep. 2019 – Dec. 2020

- Integrated a discrete element method module into the welding model to simulate the interaction between micron-size powders and high-speed gas flow in metal 3D printing.

- Developed scripts to automate repetitive simulations. Verified the model with lift coefficients and Strouhal number. Validated the model with X-ray imaging data.
- Developed scripts to post-process large data (> 5 TB). Characterized the modes of powder-gas interaction to improve the understanding of powder spattering (defects).
- Utilized simulations to investigate the applicability of a novel process design, i.e., changing the ambient pressure in the build chamber. Predicted the effects of powder-gas behaviors.

Deep Learning for Laser Absorption by Metal Surface Jan. 2020 – April 2020

- Extracted laser absorption distribution on the surface of molten metal from the laser welding model, as the training and validation data sets.
- Applied convolutional neural network algorithms using Tensorflow to predict the laser absorption distribution for random molten metal surfaces in laser welding.

Metallurgical Modeling for Direct Laser Deposition Nov. 2016 – May 2018

- Developed a process model that simulates the thermal history and surface evolution in direct laser deposition processes.
- Implemented a cellular automata algorithm with a hybrid MPI-OpenMP parallelization (in C/C++) to simulate the grain melting, nucleation, and growth.
- Conducted simulations to identify nucleation conditions to tailor distinct grain morphology, e.g., small equiaxed grains and large columnar grains.

Laser Absorption by Powder Bed Sep. 2015 – Aug. 2016

- Implemented a rain-dropping algorithm to generate randomly packed beds of powders as in typical metal 3D printing processes.
- Implemented the ray-tracing algorithm to simulate the multiple reflections of a laser beam on the surfaces of powders.

SELECTED PUBLICATIONS (full list: https://xuxiaoli-1993.github.io/publications.html)

1. **Li, X.**, Zhao, C., Sun, T., Tan, W., 2020. Revealing transient powder-gas interaction in laser powder bed fusion process through multi-physics modeling and high-speed synchrotron x-ray imaging. Additive Manufacturing, 35, p.101362.
2. Zhao C., Parab, N.D., **Li, X.**, Fezzaa, K., Tan, W., Rollett, A.D., Sun. T., 2020. Critical instability at moving keyhole tip generates porosity in laser melting. Science, 370(6520), pp.1080-1086.
3. **Li, X.**, Tan, W., 2020. Numerical modeling of powder-gas interaction relative to laser powder bed fusion process. Journal of Manufacturing Science and Engineering, 143(5), pp. 054502.
4. Kouraytem, N., **Li, X.**, Cunningham, R., Zhao, C., Parab, N., Sun, T., Rollett, A.D., Spear, A.D., Tan, W., 2019. Effect of laser-matter interaction on molten pool flow and keyhole dynamics. Physical Review Applied, 11(6), p.064054.
5. Zhao, C., Guo, Q., **Li, X.**, Parab, N., Fezzaa, K., Tan, W., Chen, L., Sun, T., 2019. Bulk-explosion-induced metal spattering during laser processing. Physical Review X, 9(2), p.021052.
6. **Li, X.**, Tan, W., 2018. Numerical investigation of effects of nucleation mechanisms on grain structure in metal additive manufacturing. Computational Material Science, 153, pp.159-169.