XUXIAO LI

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

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 3D printing.
Coursework: Computational Fluid Dynamics (CFD), Thermodynamics, Heat Transfer, Numerical Solution of PDE, Physical Metallurgy, Machine Learning.

Tongji University Shanghai, China
B.S., Aircraft Manufacturing Engineering June 2015
Coursework: Solid and Structral Mechanics, Control Theory, Aerodynamics.

TECHNICAL SKILLS

Programming: Fortran, C, C++, Python, Matlab, Java.
High-Performance Computing: MPI, OpenMP, Linux/Bash, GDB, Valgrind, Intel Profiler.
Software: StarCCM+, Abaqus, COMSOL, Tecplot, Paraview, Gmsh.

WORK EXPERIENCE

Global Engineering & Materials, Inc., Research Engineer May 2021 – Present

- Developed CFD process models for liquid composite molding and additive friction stir deposition with StarCCM+ (porous media, volume-of-fluid, and non-Newtonian flow).
- Coordinated meetings with team members to check status, collect data, and assign tasks. Assisted proposal writing for government-funded programs.

Ph.D. RESEARCH EXPERIENCE

CFD Software Development Nov. 2016 – May 2021

- Maintained an in-house CFD code, GEMS (in Fortran, over 25000 lines), for both compressible and incompressible flows, featuring the finite volume method, unstructured mesh, and MPI.
- 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, 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 (based on GEMS) that simulates the laser-metal interaction, melting and evaporation, molten pool flow, and gas dynamics in laser welding.
- Coordinated with experimentalists to compare the simulation with X-ray imaging data.
- 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 over 150 simulations. Verified the model with lift coefficients and Strouhal number. Validated the model with X-ray imaging data.
- Post-process large data (> 5 TB). Characterized the modes of powder-gas interaction to improve the understanding of powder spattering (defects).
- Numerically investigated the applicability of a novel process design, i.e., changing the ambient pressure in the build chamber. Predicted the design's effects on 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 Energy Deposition Nov. 2016 – May 2018

- Developed a process model that simulates the thermal history and surface evolution in direct energy 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.**, Guo, Q., Chen L., Tan, W., 2021. Quantitative investigation of gas flow, powder-gas interaction, and powder behavior under different ambient pressure levels in laser powder bed fusion. International Journal of Machine Tools and Manufacture, 170, 103797.
2. **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.
3. 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.
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. **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.