

XUXIAO LI

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PhD with 5 years' experience in physics-based modeling and computation

- Expertise in computational fluid dynamics, heat transfer, and material science.
- Experienced with the simulation of manufacturing processes, e.g., 3D printing.
- Managed both large scientific codes and commercial software.

EDUCATION

Tongji University Shanghai, China
B.S./Aircraft Manufacturing Engineering June 2015

University of Utah Salt Lake City, Utah
M.S./Mechanical Engineering May 2019
Ph.D./Mechanical Engineering, Advisor: Prof. Wenda Tan Expected Dec. 2020

Relevant Coursework

Finite Elements	Heat Transfer	Thermodynamics
Computational Fluid Dynamics	Turbulence	Kinetics
Machine Learning	Radiation	Optics

TECHNICAL SKILLS

Linux	Git	Latex	Fortran	c/c++	Python
MATLAB	Comsol	Abaqus	MPI	OpenMP	Profiling

RESEARCH EXPERIENCE

Laser Absorption by Powder Bed 2015 – 2016

- Implemented a rain-dropping algorithm to generate randomly packed beds of powders as in typical laser powder bed fusion processes.
- Implemented the ray-tracing algorithm to model the multiple reflections of a laser beam on the surfaces of powders.
- Conducted parametric studies on the effects of powder size, powder bed thickness, and powder material on the laser absorption distribution within the powder bed.

GEMS Maintenance 2016 – Now

- Maintaining a legacy code (in Fortran, over 25000 lines), General Equation Mesh Solver (GEMS), for solving general partial differential equations with unstructured mesh and MPI parallelization.
- Implemented the Level-Set and Ghost Fluid Method (over 10000 lines) into separate modules, and integrated the new modules into GEMS to enable multi-phase, free-surface flow and fluid-solid interaction computations.
- Designed and conducted simulations of over 15 benchmark fluid dynamics problems for

systematic verification of GEMS and the new modules.

Cellular Automata Simulation for Grain Nucleation and Growth 2016 – 2018

- Developed a thermal model (based on GEMS) that simulates the heat transfer and temperature field in direct energy deposition (DED) processes.
- Implemented the Cellular Automata (CA) algorithm to simulate the grain nucleation and growth given the temperature field from the thermal model. Parallelized the CA algorithm with hybrid OpenMP and MPI.
- Conducted simulations to identify nucleation conditions for tailoring distinct grain morphology in DED processes.

Keyhole Dynamics in Laser Welding 2018 – Now

- Developed a multi-physics model (based on GEMS) that simulates the laser absorption, molten pool flow, evaporation/condensation kinetics, thermal-capillary forces, and keyhole evolution in laser welding processes.
- Synthesized results from simulations and X-ray imaging experiments (from collaborators) to make estimations on the magnitude of the various driving forces on the keyhole.
- Provided mechanism explanations on the relationship between process parameters, keyhole oscillation, and defect formation.

Powder-gas Interaction in Laser Powder Bed Fusion 2019 – Now

- Implemented a Lagrangian-point forcing scheme and the Discrete Element Method upon the laser welding model to simulate the powder motion in laser powder bed fusion processes.
- Identified characteristic modes of powder-gas interaction based on the quantification of the surrounding gas flow and gas-induced forces on powders.
- Conducted simulations to identify the effects of ambient pressure on the gas flow and statistics of spattered powder, e.g., ejecting angle, temperature, and velocity.

PUBLICATIONS

Selected Papers complete list at <https://xuxiaoli-1993.github.io/publications.html>

1. **Li, X.**, Tan, W., 2016. Numerical investigation of laser absorption by metal powder bed in selective laser sintering processes. Solid Freeform Fabrication Symposium 2016, Austin, TX.
2. **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.
3. 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.
4. **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.