



MECHANICAL ENGINEERING

SEMINAR

1. Title: Multiphysics Modeling of Process–Structure–Property Linkages and Inverse Design for Metal Additive Manufacturing

2. Speaker: Kang-Hyun Lee, Ph.D.

Assistant Professor

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3. Time: 2026-06-01 (Mon) 14:00-15:00

4. Location: Room 204 , Building 301



5. Abstract : Metal additive manufacturing (AM) has greatly expanded the design space of advanced engineering components by enabling geometric freedom and spatial control over microstructures and material compositions. These capabilities open new opportunities to explore property and performance spaces beyond the reach of conventional manufacturing methods, but they also require a deeper understanding of process–structure–property (PSP) linkages. In metal AM, component performance is governed by strongly coupled relationships among processing parameters, microstructure evolution, and resulting material properties. A predictive PSP modeling framework therefore provides a critical foundation for understanding process-induced material behavior and enabling physics-informed design of metal AM processes and components. In this talk, I will first present an integrated multiphysics modeling framework for PSP linkages in metal AM. The framework incorporates multiple simulation modules based on thermo-fluid dynamics and metallurgical modeling to analyze how manufacturing-induced material heterogeneity affects macroscopic properties and performance. Corresponding experimental validation will be also discussed, along with an integrated workflow for PSP linkage analysis and process-window identification. Finally, I will briefly discuss how PSP modeling frameworks can be used to generate physics-informed datasets for data-driven design. As an example, I will show how simulation-generated datasets and surrogate models can be integrated with artificial intelligence (AI)-based inverse design methods to explore high-performance additively manufactured material architectures.

6. Bio : Kang-Hyun Lee is an Assistant Professor in the School of Mechanical Engineering at Soongsil University. Prior to joining Soongsil University, he worked as a Postdoctoral Associate in the Department of Mechanical Engineering at the Massachusetts Institute of Technology, where he contributed to a Defense Advanced Research Projects Agency (DARPA)-funded research project focused on developing generative artificial intelligence for the design and additive manufacturing of reusable rocket components. He received his Ph.D. and M.S. from the Department of Aerospace Engineering at Seoul National University, with a research focus on multiphysics and multiscale simulation of metal additive manufacturing processes. His current research lies at the intersection of generative design and advanced manufacturing, aiming to unlock the full potential of manufacturing processes and expand the design space for next-generation engineered systems.

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