

2026

전문가 초청 세미나

BK21 FOUR Special Seminar Series

Date 5/27 (WED) 16:00

Venue Rm.1355-2.Bldg.301

Title

Generative AI-Based Design Optimization of Next-Generation Aerospace Materials and Components

Speaker

Professor Kanghyun Lee of Soongsil University



[Education]

- 2024 Ph.D., Aerospace Engineering, Seoul National University
- 2020 M.S., Aerospace Engineering, Seoul National University

[Professional Experience]

- 2026-Present Professor, Soongsil University
- 2025-2026 Postdoctoral Fellow, MIT

Abstract

Advanced manufacturing has greatly expanded the design space of advanced aerospace components by enabling both geometric freedom and spatially varying material composition fields, which broaden the achievable property and performance spaces. However, the nonlinear and high-dimensional coupling among composition, properties, and performance creates a highly complex design space for conventional optimization methods that rely on simplified parameterizations and costly repeated simulations. In this talk, I will present a generative-model-based integrated design framework for functionally graded blisks (blade-disk) targeting reusable turbomachinery operating under demanding thermo-mechanical conditions. The framework combines materials informatics, lifting simulations, and physics-guided generative modeling to enable performance-driven design of graded composition fields. To provide physics-based guidance to the generative model, I will discuss material and performance surrogate models trained using an Integrated Computational Materials Engineering (ICME) dataset that incorporates experimentally calibrated property models, lower-bound analysis, and finite-life fatigue predictions under transient thermo-mechanical loading. I will further show how these surrogates are integrated into a guided-diffusion optimization framework that generates graded material architectures maximizing performance metrics such as elastic limits, shakedown limits, and thermo-fatigue life while satisfying manufacturability and physical constraints. Finally, I will share how this integrated approach enables efficient exploration of high-performance graded designs that surpass monolithic configurations.

