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**CENTER FOR EMBEDDED & CYBER-PHYSICAL SYSTEMS**
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# CECS Seminar



## *"From Domain-Specific Accelerators to Spatial Architecture Exploration"*


## Jongeun Lee

Professor, Ulsan National Institute of Science and Technology (UNIST)


Thursday, July 30th
10:30-11:30 a.m.
Location: ISEB 1310


**Abstract:**
Emerging scientific and machine learning workloads increasingly benefit from domain-specific hardware accelerators, yet designing efficient architectures for these applications requires both effective implementations and scalable methods for architectural exploration. In this talk, I will present our recent research on accelerator design and architecture exploration for spatial computing systems.

I will first introduce AccelOrb, an FPGA accelerator for Orb v2, a graph neural network-based machine learning force field (MLFF) used in molecular dynamics simulations. By analyzing the application's computational bottlenecks and memory requirements, we develop a memory-aware streaming architecture that substantially improves performance while operating within the resource constraints of a modern FPGA.

Building on the lessons learned from accelerator implementation, I will then discuss FlowSpec, a flexible framework for modeling and simulating coarse-grained spatial architectures. Rather than targeting a single accelerator design, FlowSpec provides a scalable interface between application mapping and architectural simulation, enabling rapid exploration of diverse compute organizations and communication networks.

Together, these efforts highlight a research direction that bridges application-driven accelerator design with the systematic exploration of future spatial architectures.


**Biography**:
Jongeun Lee received his B.S. and M.S. degrees in Electrical Engineering and his Ph.D. in Electrical Engineering and Computer Science from Seoul National University, Korea. In 2009, he joined Ulsan National Institute of Science and Technology (UNIST), Ulsan, Korea, where he is currently a Professor at the Department of Electrical Engineering. Before joining UNIST, he was a postdoctoral research associate at Arizona State University in Tempe, Arizona, USA, and also worked at Samsung Electronics, Korea.

Professor Lee has authored more than 100 peer-reviewed journal and conference publications. He currently serves as Editor-in-Chief of IEEE Embedded Systems Letters and has served on the technical program and organizing committees of numerous conferences and workshops in computer-aided design and reconfigurable computing. His research interests include hardware/software co-design, reconfigurable architectures, deep learning, and computer-aided design for emerging technologies.

**Hosted By**: Prof. Fadi Kurdahi