

# Time-Efficient Machine Learning (ML)-aided Electric Design Automation (EDA) for Power Conversion Systems Enabled by FPGA Accelerators - A Fast Power Converter Auto Designer

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## Abstract

The continuous development of electronic devices has sparked ongoing interest. These devices have greatly enhanced people's comfort and overall quality of life. Power conversion systems play a crucial role in providing essential power to electric devices, serving as the heart of these devices. The field of Power Electronics focuses on studying and improving the performance of power conversion systems, including the control of energy flow and their conversion into suitable forms for electronic devices. With the industry's increasing demand for high efficiency and power density, power electronics has become increasingly significant.

This seminar aims to introduce the fundamental principles of power electronics and their practical applications. The studies to improve the efficiency of power conversion systems will be presented. Additionally, it will delve into a reinforcement learning (RL)-based design, specifically focusing on a novel FPGA architecture that accelerates circuit simulation. The FPGA accelerator efficiently converts circuit topology and parameters into core matrices, enabling rapid and efficient design optimization. The proposed RL-based design method for power converters, utilizing this FPGA accelerator, substantially increases speed, resulting in a 60 times overall speedup compared to the usage of a popular commercial simulator.

## Bio



Dr. Yeonho Jeong is an Assistant Professor of Electrical, Computer, and Biomedical Engineering at University of Rhode Island. He received a Ph.D. degree in Electrical Engineering from the Korea Advanced Institute of Science and Technology (KAIST) in 2018. During the period spanning from 2008 to 2018, Dr. Jeong worked as a Senior Research Engineer for Samsung Electro-Mechanics and Solu-M in South Korea. In this role, he focused on the exploration of server and network power systems. Following that, from 2018 to 2020, he pursued his postdoctoral research at the Department of Electrical/Mechanical Engineering at the

University of Colorado Denver. His research during this period received support from the Defense Advanced Research Projects Agency (DARPA).

Dr. Jeong's research interests revolve around high-performance power conversion systems, with a particular emphasis on hybrid power systems, energy management for electric transport, design automation, and digital control approaches for a wide range of power converters.