

Interdisciplinary Initiatives for Future Engineering

## 多元融合 创新引领 系列学术报告-2

Interdisciplinary Initiatives for Future Engineering (In2Future) Colloquium Series

## How does the Partial Element Equivalent Circuit (PEEC) Method Provide Favorable Solutions for Stateof-the-art Electromagnetic Problems

- Time: Thursday, June 23, 2022 2:30pm-4:00pm
- Join Us Online: <u>https://zju.webex.com/meet/srtan</u>



Language: English

Conventional computational electromagnetic (CEM) methods have hit the bottleneck because of the exponential increase in electronic device complexity and operating frequency. Predicting electromagnetic performance accurately and effectively is a crucial need in the system-level design and optimization of state-of-the-art electronic devices. Compared with other numerical methods, the PEEC method stands out by the unique capability of describing general EM problems by physically meaningful equivalent circuits, which can be employed by conventional SPICE-like circuit solver efficiently for both the frequency and time domain simulations. A novel PEEC model for general heterogenous integrations with significant efficiency improvement and strong physics insight will be discussed.

Moreover, physics-informed artificial intelligence is a promising candidate to address the inverse scattering problem by fusing rigorous PEEC models with intelligent machine learning algorithms. An example of Generative Adversarial Networks (GAN) leveraged PEEC modeling approach to address inverse electromagnetic scattering problems will be discussed. Learning from a tailored training set that imitates the conducting traces of integrated circuit, the pix2pix GAN confines the solutions to a physically meaningful subset. The proof-of-concept example shows that a well-trained pix2pix GAN can effectively reconstruct conductor structures with high confidence and have excellent agreement with the ground truth.





Figure 1. Illustration of the PEEC Modeling of heterogenous integrations.

Figure 2. Generative Adversarial Networks (GAN) leveraged PEEC modeling for inverse scattering problems.



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Dr JIANG Yang is a research scientist with the Institute of High-Performance Computing, Agency for Science, Technology, and Research (IHPC, A\*STAR), Singapore. He received his Bachelor's and PhD degrees in electronic engineering from the Chinese University of Hong Kong in 2013 and 2019, respectively. He devoted nearly ten years to the development of the partial element equivalent circuit (PEEC) method to address various electromagnetic problems in cutting-edge technologies, i.e., heterogenous integrations, periodic structures, radiation analysis, etc., which are well recognized by the experts in computational electromagnetics domain. Besides electromagnetic modelling, his current research interests expand to utilize the PEEC method in developing physics-informed artificial intelligence models, model order reduction algorithms, and equivalent circuit reconstruction for inverse scattering problems.

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