Joint CQSE & NCTS Seminar

2024
May 24, Friday

TIME: May 24, 2024, 14:30~15:30 pm

TITLE: Introducing D-Wave's Quantum Annealer and Hybrid Solvers for Inverse Lithography Optimization

SPEAKER: Prof. Peichen Yu (Department of Photonics, National Yang Ming Chiao Tung University)

PLACE: NCTS Physics Lecture Hall, 4F, Chee-Chun Leung Cosmology Hall, NTU

ONLINE: https://nationaltaiwanuniversity-zbn.my.webex.com/

Abstract:

Inverse lithography technology (ILT) is a promising computational technique for enhancing the resolution and process window of advanced optical lithography systems. However, the computational complexity of ILT poses significant challenges. In this seminar, we introduce D-Wave's quantum annealer and hybrid quantum-classical solvers as a novel approach to tackle the computationally intensive task of mask optimization in ILT. We present an overview of the ILT problem formulation as a quadratic unconstrained binary optimization (QUBO) problem, which can be mapped onto the quantum annealing hardware. Our experimental results, obtained using the D-Wave Advantage system, demonstrate the impact of various annealing parameters on the quality of the optimized mask solutions. Furthermore, we introduce a hybrid approach combining the global quantum search capabilities of the quantum annealer with local refinement using the classical steepest descent algorithm. This hybrid quantum-classical approach shows improved probabilities of finding optimal mask solutions while significantly reducing computational runtime compared to purely classical solvers. Finally, we discuss the scalability of our approach and the current limitations of quantum hardware. Through this seminar, we aim to introduce the potential of quantum annealing and hybrid quantum-classical computing in accelerating inverse lithography and other complex optimization tasks in semiconductor manufacturing.

Biography:

Peichen Yu (M'06) received her Ph.D. degree in electrical engineering from the University of Michigan, Ann Arbor, MI USA in 2004. From 2004 to 2006, she joined the Advanced Design group of Intel Corporation at Hillsboro, Oregon USA as a resolution enhancement technology (RET) design engineer. Since 2006, she switched careers to academia and is currently a Professor with the Department of Photonics at National Yang Ming Chiao Tung University. Her research focuses on nanostructures and metasurfaces patterning for optoelectronic applications. She is also actively engaged in the development of RET solutions including inverse lithography technology (ILT) for ArF 193i and EUV lithography. She has published over 60 refereed technical papers in the above research areas. Her work has been highlighted in various scientific journals including Virtual Journal of Nanoscale Science & Technology, SPIE newsroom, NPG Nature Asia-Material, etc. Dr. Yu has received several research and teaching awards in Taiwan and is currently a member of IEEE Photonics Society and SPIE.