MEng Design Project Announcement – 2018

Project Title: High Speed Nanomachines for Semiconductor Metrology

Overview: The demand for low powered, high performance electronic devices has triggered the aggressive scaling down of transistors into the 10 nm node and beyond technologies. However, problems remain. Besides the complex lithographic challenges that are eminent at these nodes, device testing struggles continue to persist. At these extreme nodes, conventional optical techniques for failure analysis are ineffective due to wavelength limitations. Xallent will extend device failure isolation and analysis into the 10 nm node and beyond by developing high speed and cost effective nanomachines for semiconductor metrology.

Xallent is seeking an interdisciplinary MEng team to work on a nanomachine project.

Team Member 1 Contribution: Student will develop image and pattern recognition algorithms to rapidly detect features of interest for further processing. The output images would further be processed by Team Member 2 who will use the results to optimize the motion of the nanomachine.

Required Skills: Skills required include image analysis and programming (LabVIEW, MATLAB, other)

Team Member 2 Contribution: The student will develop optimization algorithms to allow for fast movement of the nanomachine. As a matter of creativity (and not required), student may explore the use of deep learning or neural networks to optimize the motion of the nanomachines. This student could closely work with Team Member 1 to achieve end goal.

Required Skills: Optimization and programming (LabVIEW, MATLAB, other)

Team Member 3 Contribution: The student will design actuation and sensing networks using operational amplifiers and passive components to power the nanomachines. Controls and feedback processes will be used to stabilize the motion of the nanomachine.

Required Skills: Analog circuit design, controls and feedback

Team Member 4 Contribution: The student will use the nanomachines to investigate charge transport in thin film materials and semiconductor devices. Transport mechanisms across grain boundaries and effects of workfunction difference will be investigated.

Required Skills: Electronic properties of materials and charge transport in materials

Estimated Project Time Frame: One (1), Two (2) Semesters or summer.

ECE Advisors
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Outside Client, Name and Affiliation:
Xallent (Ithaca, NY) designs, develops, manufactures and markets advanced nanoprobing solutions for imaging, electrical measurement and testing of thin film materials and semiconductor devices. The Company’s products enable on-wafer measurements and failure analysis of integrated circuits. Product design, manufacture and assembly are conducted in Ithaca, New York. Xallent has applied its technology to address key challenges for the US Department of Defense (DoD) in the area of IC forensics. Currently, under a National Science Foundation (NSF) grant, Xallent is developing nanomachines to analyze failure modes of IC chips at extreme technology nodes.