Mechanical & Industrial Engineering
UNIVERSITY OF TORONTO

MIE498H1: Research Thesis 2025-2026

Supervisor	Andreas Mandelis
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Number of Positions	2
Open to	Mechanical and Industrial Engineering Students
Term Offered	Full-year
Research Area	Materials Optoelectronics, solar cells and non-destructive imaging
Research Topic	Development of Non-Destructive Optoelectronic Diffusion-Wave Imaging for Solar cells and other Electronic Devices at Micrometer/Sub-micrometer levels

Project Description

The UofT pioneered non-contact and fully optical Lock-In Carrierography Imaging (LICI) method shows excellent potential for characterizing Silicon Solar cells and other electronic devices. However, this method has only been used for the investigation of large area devices. To-date, highly resolved imaging of microscopic structures, such as photosensitive pixel devices in matrix or microscopic defects in solar cells, is in strong demand as there are no alternative methods. Using a high-speed, high-resolution near-infrared camera and 4 degree Kelvin Ultrazoom system with a short-wave infrared lens, a new LICI microscopy system is being developed. This new system will be used with various wavelength laser photocarrier excitation beams for non-destructive characterization of (sub)microscopic defects in optoelectronic structures as a feedback method to advanced device fabrication and manufacturing.

Additional Information	Application: Automated Miniaturized 3D Scanning Stage: Designing an automated miniaturized 3D scanning stage for a photothermal imaging system is a challenging yet rewarding project. This involves creating a compact and precise scanning mechanism that can be integrated into existing imaging systems. The goal is to achieve high-resolution imaging with minimal manual intervention, thereby increasing efficiency and accuracy. Students will apply their hands-on experience in mechanical design, automation, and system integration, making this project ideal for those interested in robotics and imaging technologies.
Application Instructions	Submit unofficial transcript to Professor Andreas Mandelis (mandelis@mie.utoronto.ca)