

**Ph.D. in Information Technology
Thesis Defense**

March 17, 2023

at 15:00

Room Beta and online by Zoom

Paola PIEDIMONTE – XXXV Cycle

**ELECTRONIC BIO-RECONFIGURABLE IMPEDANCE PLATFORM FOR HIGH SENSITIVITY
DETECTION OF TARGET ANALYTES**

Supervisor: Prof. **Marco Sampietro**

Abstract:

This work presents an electronic bio-sensing system based on the detection of the impedance variation between gold microelectrodes on the capture of target analytes with nanoparticle amplification.

The electrodes are designed in a differential configuration, reference and active sensor, to counteract all possible mismatches such as temperature fluctuations and variations in the ion content of the solution. The sensor are integrated in a microfluidic system for precise control of the target solution. The successful combination of these elements has made it possible to reach a limit of detection of the system below 100 pg/mL for IgG antibodies in buffer. Toward measurements of viral infections by detecting antibodies, the system has been challenged with infected human serum samples for digital counts of anti-dengue virus antibodies, achieving the detection of clinically relevant target concentrations. Also, the bio-reconfigurability of the system has been successfully tested with oligonucleotides detection down to pM target concentration. To allow the portability of the entire measurement setup, the system has been equipped with a custom electronic board based on FPGA module allowing a multiplexing approach for the parallel reading of several electrodes. The final system enables simple and effective bio-reconfigurability, leveraging advances in biomolecular recognition through appropriate selection of bio-probes, and allows extending the applicability of multiplex sensing to a broad range of needs.

PhD Committee

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Prof. **Heinz-Bernhard Kraatz**, University of Toronto Scarborough