PhD. Dissertation Defend Examination

Presented by

Mr. Thet Pai Oo

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Biomedical Sample Characterization Using Electromagnetic Waves

Highlight Summary

This study presents the development and analysis of novel electrode configurations for capacitive sensing applications based on electrostatic and semi-static cellular structures. Utilizing electromagnetic simulation software, mathematical modeling, and advanced fabrication techniques, coplanar interdigital structures, circular electrodes, and various capacitive sensor configurations, including circular shape parallel plate capacitor, dipole electrodes, and cylindrical capacitance electrodes, were designed. These designs were tailored with distinct physical attributes such as finger length, electrode width, inter-electrode spacing, finger width of interdigital electrodes, and gap dimensions between electrodes. Styrofoam beads and polystyrene culture wells were employed as representative cell samples and containment structures, respectively. Frequency analysis was conducted within the range of 1MHz to 3.5 GHz to assess the frequency responses of the electrodes. The reflection coefficient, conductivity, and susceptibility of both the interdigital and circular shape electrodes were quantified during the frequency sweep to facilitate comparison and selection of the optimal electrode design. Subsequently, the chosen sensor design was integrated into a microfluidic system for further testing and implementation. Capacitive sensing methods were utilized to analyze the properties of liquid samples within microfluidic tubes, allowing for the measurement of changes in capacitance induced by the presence and characteristics of the liquid sample. Parameters such as dielectric constant, conductivity, and viscosity were assessed. The sensors were fabricated according to the designated design specifications, and measurements were conducted using actual cell samples employing a vector network analyzer (VNA). This instrumentation enabled precise characterization of the sensor's performance by recording data pertinent to parameters such as reflection coefficient, conductivity, and susceptibility.

Date	Time	Venue
May 5th, 2026	13:00-15:00	Room: Cologne Meeting Room, TGGS Building, KMUTNB

No registration required.