## PhD Oral Defense

**Date:** **27 August 2020 (Thursday)** **Time:** **2:00pm**

## Thesis Title

**Evanescent Scattering by Ferromagnetic Microparticles for Versatile Optical Sensing**

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## Abstract

Optical waveguide sensing (OWS) has been emerging as a key enabling technology in environment monitoring, healthcare, manufacturing control, and industrial technologies. In most cases, OWS technologies facilitate the optical sensing relying on the interaction of the evanescent waves with the sensing medium located at the waveguide layers. By adopting proper designs, the evanescent interactions can be implemented by evanescent wave absorption, evanescent wave coupling or evanescent wave scattering (EWS). In comparison to the others, EWS sensors offer many advantages which include broadband functionality, no polarization selectivity, ease of operation and design implementation with low cost. In this thesis, we devote to developing a few EWS platforms for versatile optical sensing based on a planar waveguide structure. To facilitate the evanescent scattering, low-cost ferromagnetic microparticles, i.e. carbonyl iron particles (CIPs), were designed in form of either self-assembled ferromagnetic cantilevers or magnetorheological film. In the meantime, the microparticles will be positioned in close proximity to a liquid-cladded optical waveguide. Three examples, namely, an AC current sensor, a submicron vibration sensor and a magnetic field sensor were successfully designed, experimentally verified and compared with other sensing schemes. The proposed sensing applications will find potentials of further packaging for industrial and commercial products. In addition, the proposed EWS platforms show great potentials to be extended for other sensing uses by proper designs.