# MICROFLUIDIC LENS ACTUATION VIA ENHANCED ELECTROWETTING ON DIELECTRIC (EWOD)

By

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# ABSTRACT

This thesis presents the proof of concept of an adaptive microfluidic lens MEMS device. The focal length is controlled using the electrowetting on dielectric effect in liquid environment. By using the currently available materials, a process technology was developed to achieve an ultra smooth surface for good hydrophobic properties and to control the thickness of the hydrophobic layer, which is later on implemented in the microfludic optical MEMS device. A stack oxide-nitride (ON) layer was developed for the microfludic MEMS device electrowetting on dielectric (EWOD) actuation for higher performance and lower voltage operation. A liquid-liquid system is found for micro-scale optical applications. By choosing proper liquid-liquid system, the gravitational effect can be eliminated even up to millimeter size liquid lens; hence distortions induced by gravity can be totally eliminated for the liquid-liquid optical micro system.

A new microlens design and MEMS technology was developed to construct an adaptive optical microsystem that operates under low actuation voltage. A model was developed to predict the change in focal length with applied voltage and time response of this microfludic lens. A proof of concept was successfully demonstrated. The design can be used to construct micrometer – millimeter range adaptive microfludic lens that can operate at low voltage, eliminate the distortions induced by gravity, has no evaporation and less contact angle hysteresis.