UCF DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCEINCE

Spring 2015 Seminar Series

Presented by the ECE Division

INDUCTIVE POSITION SENSING FOR LARGE DISPLACEMENT MICROMIRRORS IN MATERIAL ANALYSIS APPLICATIONS

THURSDAY APRIL 9, 2015

2:00 PM – CREOL 103

Micro-electro-mechanical system (MEMS) technologies have enabled highly integrated microsystems that provide more functionality while utilizing space/material more efficiently. In particular, using large vertical displacement (LVD) MEMS micromirrors as the movable mirror in Fourier transform spectrometers (FTS) offers great potential for miniaturization such that real-time on-site material analysis can be enabled. In MEMS FTS systems, it is desired for the mirror plate to have a large and linear piston scan range (above 100 mm) to achieve higher resolution, but at the same time have very small tilting to minimize misalignment issues. Ultimately, closed-loop control of the mirror plate position is necessary, which requires a suitable position sensor to be integrated with the micromirror to monitor the mirror plate.

The focus on this talk will be on the development of an inductive eddy current based position sensor that is applied to an electrothermal LVD micromirror. The advantages of utilizing inductive sensing will be explained, as well as the principle, design, fabrication, interface circuitry, and measurement results. The sensor consists of two microfabricated coils packaged under the mirror plate, and supports both amplitude and frequency detection modes. Amplitude detection is achieved by sensing the coupling change between the coils when the mirror plate moves, and a piston sensing range of 1 mm could be obtained with nanometer resolution. Frequency detection is achieved by sensing the inductance change of both coils, and can simultaneously monitor piston position and tilt angle over a 500 mm range.

In the second part of this talk, ongoing research on utilizing microfabrication technologies to produce high density power inductors and RF capacitors will be introduced, as well as a MEMS based energy harvesting system. This talk will be concluded with a look toward future research areas in optical and power MEMS.

DR. VICTOR TSENG

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Victor F.-G. Tseng received his Ph.D. degree in Electrical and Computer Engineering from the University of Florida, Gainesville, FL, USA, in 2015. He also received his B.S. and M.S. degrees in Electrical and Computer Engineering from National Chiao Tung University, in 2005 and 2007, respectively. From 2009 to 2010, he was with Texas Instruments, where he worked as a product engineer for the Digital Light Processing (DLP) pico-projector optical MEMS products at the assembly and test site in Taiwan. During his time at the University of Florida, he also assisted with the re-development of the lab teaching material for the Electronic Circuits I/II courses at the ECE department. He is a member of IEEE Electron Devices Society, and has served as a reviewer for multiple journal papers. His research interests and experience encompass the fields of optical micro-electro-mechanical systems (MEMS), energy harvesting devices, inductive position sensing for MEMS devices, micro sensors and actuators, and integrated high density capacitors and inductors for RF and power applications.