Surface acoustic wave (SAW) sensors offer a wireless, passive sensor solution for use in numerous environments where wired sensing can be expensive and infeasible. Single carrier frequency SAW sensor embodiments such as delay lines, and resonators have been used in single sensor environments where sensor identification is not a necessity. The orthogonal frequency coded (OFC) SAW sensor tag embodiment developed at UCF uses a spread spectrum approach that allows interrogation in a multi-sensor environment and provides simultaneous sensing and sensor identification.

The SAW device is encoded via proper design of multiple Bragg reflectors at differing frequencies. To enable accurate device design, a model to predict reflectivity over a wide range of electrode metallization ratios and metal thicknesses has been developed and implemented in a coupling of modes (COM) model. The high coupling coefficient, reflectivity and temperature coefficient of delay (TCD) of YZ LiNbO3 makes it an ideal substrate material for a temperature sensor, and the reflectivity model has been developed and verified for this substrate.

A new concept of pseudo-orthogonal frequency coded (POFC) SAW sensor tags has been investigated, and with proper design, the POFC SAW reduces device insertion loss and fractional bandwidth compared to OFC. OFC and POFC sensor devices have been fabricated at 250 MHz and 915 MHz using fundamental operation, and 500 MHz and 1.6 GHz using second harmonic operation. Measured device results are shown and compared with the COM simulations using the enhanced reflectivity model. Additionally, the first OFC devices at 1.05 GHz were fabricated on 128o YX LiNbO3 to explore feasibility of the material for future use in OFC sensor applications.

Devices at 915 MHz have been fabricated on YZ LiNbO3 and integrated with an antenna, and have then been used in a transceiver system built by Mnemonics, Inc. to wirelessly sense temperature. The first experimental wireless POFC SAW sensor device results and predictions will be presented.

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Approved for distribution by Dr. Donald Malocha, Committee Chair, on February 22, 2011.

The public is welcome to attend.