

**Department of Electrical and Computer Engineering**  
**University of Rochester, Rochester, NY**  
**Ph.D. Public Defense**

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**11:00 AM**  
**Computer Studies Building 426**

**Theory, Modeling and Design of the Indirect-Feedback Sigma-delta  
Image Sensor System**

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Professor Mark Bocko

**Abstract**

The thesis mainly focuses on the theory, modeling and design of the indirect-feedback sigma-delta image sensor and its related system design. An indirect-feedback readout architecture where the digital output of the  $\Sigma\Delta$  modulator is accumulated by a digital counter and converted to an analog voltage that serves as the reference voltage in the modulator's comparator is employed. A time-domain pixel simulator that enables assessment of the major noise contributions in this type of imager is also presented. Both Matlab and FPGA verification are presented to demonstrate the indirect-feedback readout architecture. A full chip implementation is also included with the SAR startup phase. In the last chapter, a modified discrete wavelet transform for interfacing the indirect-feedback sigma-delta image sensor is proposed and demonstrated.