



THE UNIVERSITY OF  
**CHICAGO**

Department of Statistics  
**STATISTICS COLLOQUIUM**

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## **Modal Analysis with Compressive Measurements**

**MONDAY, October 21, 2013 at 4:00 PM**

133 Eckhart Hall, 5734 S. University Avenue

*Refreshments following the seminar in Eckhart 110*

### **ABSTRACT**

Structural Health Monitoring (SHM) systems are critical for monitoring aging infrastructure (such as buildings or bridges) in a cost-effective manner. Such systems typically involve collections of battery-operated wireless sensors that sample vibration data over time. After the data is transmitted to a central node, modal analysis can be used to detect damage in the structure. In this talk, we propose and study three frameworks for Compressive Sensing (CS) in SHM systems; these methods are intended to minimize power consumption by allowing the data to be sampled and/or transmitted more efficiently. At the central node, all of these frameworks involve a very simple technique for estimating the structure's mode shapes without requiring a traditional CS reconstruction of the vibration signals; all that is needed is to compute a simple Singular Value Decomposition. We provide theoretical justification (including measurement bounds) for each of these techniques based on the equations of motion describing a simplified Multiple-Degree-Of-Freedom (MDOF) system, and we support our proposed techniques using simulations based on synthetic and real data.

Joint work with Jae Young Park and Michael Wakin.

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