



PURDUE UNIVERSITY

Special Colloquium

Speaker: Dr. Benjamin Adcock, Simon Fraser University
Title: "Generalized Sampling: Stable Signal Reconstruction in Arbitrary Bases"
Date: Friday, December 9, 2011
Time: 4:30 P.M.
Place: REC 114

Abstract

A fundamental problem in many areas of science and engineering is the recovery of an object - an image or signal, for example - from a fixed collection of its measurements (or samples). For example, in Magnetic Resonance Imaging (MRI) one is given pointwise samples of the Fourier transform of an image, and the computational task is to reconstruct the image from this finite set of data.

The purpose of this talk is to introduce a new framework for this problem, known as generalized sampling, which allows for reconstructions in arbitrary systems of functions. This framework is both numerically stable, and therefore robust in the presence of noise or other types of errors, and possesses guaranteed error bounds. As a consequence, if the given function is known a priori to have a good representation in terms of a particular system of functions (e.g. splines, wavelets, piecewise polynomials,?), then one can always compute a good approximation in this system, regardless of the type of measurements.

Although this framework is general in nature, it actually leads to new methods for a number of classical problems, which improve over existing techniques. As an example, I will consider the resolution of the Gibbs phenomenon for one-dimensional piecewise smooth signals, and compare generalized sampling to the well-known techniques of Gottlieb et al. In the final part of the talk I will also discuss several extensions of the generalized sampling framework: in particular, the case of nonuniform sampling and the solution of inverse and ill-posed problems.