Applied and Computational Mathematics and Statistics Colloquium

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will give a lecture entitled:

An Algebraic View of Low-Density Parity-Check Codes

Monday, December 13th, 2010
4:00 PM
Location: 127 Hayes-Healy Hall

Abstract:

In the last fifteen years, the area of channel coding has undergone a revolutionary change with the introduction of graph-based codes together with iterative decoding algorithms, in particular turbo codes and low-density parity-check (LDPC) codes. While the decoding algorithms are optimal when the underlying graph is a tree, such codes perform poorly, therefore, bipartite graphs with cycles are desirable over trees. However, on graphs with cycles the decoding algorithms perform sub-optimally, leading to the so-called error floors in the bit-error-rate curve (the curve measuring the code performance) at high signal-to-noise ratios. An important problem in modern coding theory is the development of mathematical tools to predict error floors and evaluate the performance of LDPC codes.

In this talk, I will address this problem for the class of quasi-cyclic LDPC codes. In particular, I will expand on the design and performance analysis of these codes through a study of the interdependencies between all relevant parameters and metrics (girth, minimum distance, pseudo-codewords and their pseudo-weight, trapping sets, fundamental cones), and present a few of our key results. I will also present briefly our development of the connection between coding theory and compressed sensing through linear programming.