THE CHINESE UNIVERSITY OF HONG KONG
Institute of Network Coding
and
Department of Information Engineering
Seminar

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Kite Codes : Design, Analysis, and Extensions

by

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Date : **28 September 2011 (Wednesday)**
Time : **2:30 - 3:30 pm**
Venue : **Room 833, Ho Sin Hang Engineering Building**
The Chinese University of Hong Kong

Abstract

We talk about a new ensemble of rateless forward error correction (FEC) codes, called Kite codes. Kite codes are a special class of prefix rateless low-density parity-check (PRLDPC) codes, which can generate potentially infinite (or as many as required) random-like parity-check bits. The performance of the Kite codes under maximum likelihood (ML) decoding can be analyzed by computing the ensemble weight enumerating functions (WEF). We propose a simulation-based optimization method as well as density evolution (DE) using Gaussian approximations (GA) to design the Kite codes. Three approaches are then presented to improve the design of Kite codes, resulting in good rate-compatible codes with rates varying continuously from 0.05 to 0.9 for additive white Gaussian noise (AWGN) channels. First, to lower down the error-floors of the original Kite codes in the high-rate region, we propose a row-weight concentration approach. Secondly, to narrow the gap between the performance of the original Kite codes and the Shannon limits in the low-rate region, we propose an accumulator randomization approach. Thirdly, to simplify the design of Kite codes, we present an empirical formula for the p-sequence. Simulation results show that, when combined with adaptive modulation, the improved Kite codes perform well in a wide range of signal-to-noise-ratios (SNRs). We also show that Kite codes can be generalized to arbitrary abelian groups, resulting in, for example， binary Kite codes, Kite codes over one-dimensional lattice, Kite codes over M-PSK signal constellations and Kite codes over multi-dimensional lattice.

Biography

Xiao Ma received the Ph.D. degree in communication and information systems from Xidian University, China, in 2000. From 2000 to 2002, he was a Postdoctoral Fellow with Harvard University. From 2002 to 2004, he was a Research Fellow with City University of Hong Kong. Since 2004, he has been a Professor with the Department of Electronics and Communication Engineering, Sun Yat-sen University, Guangzhou, China. His research interests include information theory, channel coding theory and their applications to communication systems and digital recording systems.

Dr. Ma is a corecipient, with A. Kavcic and N. Varnica, of the 2005 IEEE Best Paper Award in Signal Processing and Coding for Data Storage.

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