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

Optimal Detectors for Flash Memory Channels with Intercell Interference

by

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Time : 2:30 - 3:30 pm
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The Chinese University of Hong Kong

Abstract

Modern high density flash memory channels suffer from intercell interference (ICI). In this talk, we will derive the optimal detector design for flash memory channels that suffer from ICI. First, we rely on an old result that shows that information-theoretically optimal signaling over flash channels is discrete, even though the channel outputs are continuous. Next, we will reveal the physical ICI model that takes into account parasitic capacitance coupling from neighboring cells. At first, we will consider an (easier) one-dimensional channel model and derive the optimal structure of a Viterbi-like detector for the channel. We will reveal the signature feature of the detector as being the usage of a pair of FIR filters: i) one FIR filter for filtering the channel outputs, and ii) the other FIR filter for filtering the squares of the channel outputs. If the channel is a signal-dependent (data-dependent) channel, then there will be as many FIR filter pairs as there are distinct signal-dependent channel modes. A Gaussian approximation of the channel output pdf leads to a suboptimal detector with a rather simple filtering structure. Alternatively, implementing the exact optimal detector (without invoking the Gaussian assumption) can be obtained by taking the Fast Fourier Transform (FFT) of the moment-generating function which is attainable in closed form. Finally, we will consider extensions of the design to 2-dimensional page-oriented channels as well as different programming schedules (in particular the even-odd programming schedule). Simulation results will be shown at the end of the talk to compare the optimal detector to various suboptimal detectors derived under simplifying assumptions.

Biography

Aleksandar Kavcic received the Dipl. Ing. degree in Electrical Engineering from Ruhr-University, Bochum, Germany in 1993, and the Ph.D. degree in Electrical and Computer Engineering from Carnegie Mellon University in 1998. Since 2007 he has been with the University of Hawaii, Honolulu where he is presently Professor of Electrical Engineering. Prior to 2007, he was in the Division of Engineering and Applied Sciences at Harvard University. He also held-short term visiting and advisory positions at City University of Hong Kong, Chinese University of Hong Kong, Seagate Technology, Read-Rite Corporation, Quantum Corporation and Link-A-Media Devices. Prof. Kavcic received the IBM Partnership Award in 1999 and the NSF CAREER Award in 2000. He is a co-recipient, with X. Ma and N. Varnica, of the 2005 IEEE Best Paper Award in Signal Processing and Coding for Data Storage. He served on the Editorial Board of the *IEEE Transactions on Information Theory* as Associate Editor for Detection and Estimation from 2001 to 2004, as Guest Editor of the *IEEE Signal Processing Magazine* in 2003-2004, and as Guest Editor of the *IEEE Journal on Selected Areas in Communications* in2008-2009. From 2005 until 2007, he was the Chair of the Data Storage Technical Committee of the IEEE Communications Society.

****ALL ARE WELCOME ****

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