Center for Memory and Recording Research
Electrical and Computer Engineering Department

CMRR
UC San Diego
Electrical and Computer Engineering
JACOBS SCHOOL OF ENGINEERING

HOSTED BY PAUL H. SIEGEL

SEMINAR TALK BY
RICHARD WESEL
University of California, Los Angeles

when:
WED., FEBRUARY 21, 2018
2:30 PM Refreshments
3:00 PM Lecture

where:
JKW AUDITORIUM
CMRR Building

– biography –

Richard Wesel received the B.S. and M.S. degrees from the Massachusetts Institute of Technology, Cambridge, MA, USA, and the Ph.D. degree from Stanford University, Stanford, CA, USA, all in electrical engineering. In 1996, he joined the University of California at Los Angeles, Los Angeles, CA, USA, where he is currently a Professor with the Electrical Engineering Department and the Associate Dean for Academic and Student Affairs for the UCLA Henry Samueli School of Engineering and Applied Science. His research is in the area of communication theory, with particular interest in channel coding. He was a recipient of the National Science Foundation CAREER Award, the Okawa Foundation Award for research in information theory and telecommunications, and the Excellence in Teaching Award from the UCLA Henry Samueli School of Engineering and Applied Science.

– abstract –

'Incremental Redundancy'

This talk presents an overview on recent developments in using incremental redundancy to improve performance in practical systems. By allowing the codeword length to vary so that the codeword rate matches the randomly varying information density or "operational capacity" of the channel, systems that use incremental redundancy approach capacity with shorter blocklengths and/or lower complexity than systems that must rely on long blocklengths (and ergodicity) to allow the codeword rate to concentrate around the mutual information, which is the average of the randomly varying information density.   Systems employing incremental redundancy require rate-compatible codes and knowledge at the receiver of when to terminate decoding. In practical systems incremental redundancy symbols must be grouped into transmitted packets.

This talk presents recent developments that meet these requirents for variable-length LDPC and convolutional codes used with incremental redundancy. A novel approach for providing incremental redundancy at the bit level provides fine-grain rate compatibility for short but powerful non-binary LDPC codes. More efficient CRC design that takes into account the full structure of the convolutional code can reduce the overhead of termination, and a reduced-complexity but exact alternative to Raghavan and Baum's reliability-output Viterbi algorithm computes the probability of codeword error to provide zero-overhead termination. The sequential differential optimization algorithm optimizes the length of each packet to maximize the average throughput.   While incremental redundancy is typically used with feedback, we conclude with a system that uses the interframe-coding approach of Zeineddine and Mansour that employs incremental redundancy without feedback to allow the highly parallelized decoding of a large number of short-blocklength codes connected by common incremental redundancy.