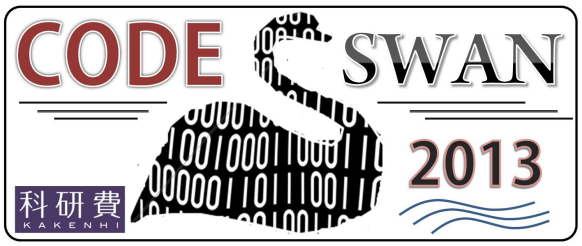
Final Program of Joint Steering Committee Meeting CODE-SWAN and COATNET2 2013



Room 1408 (14F), Osaka-Umeda Campus,
Kwansei Gakuin University
Osaka, 5–6 March 2013

(Schedule: Tuesday, 5 March 2013, 11:00–11:30)

BICM-ID-Based IDMA using Extended Mapping

Kun Wu, Khoirul Anwar and Tad Matsumoto

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The primary objective of this talk is to propose a novel technique for Interleave Division Multiple Access (IDMA) based on the Bit-Interleaved Coded Modulation with Iterative Detection/Decoding (BICM-ID) using extended mapping (EM). To design near-capacity achieving low-rate code and to determine the optimal labeling pattern for BICM-ID, EXtrinsic Information Transfer (EXIT)-constraint Binary Switching Algorithm (EBSA) is used. Both single user detection (SUD) and multiple user detection (MUD) are considered in this talk, where in MUD a serial soft successive interference cancellation (SSIC) technique is adopted. Furthermore, for MUD, equal and unequal power allocation cases are also considered. Results of both two and three dimensional EXIT chart analyses are presented to show very close matching of the demapper and decoder's EXIT curves/planes. Three dimensional trajectory evaluation results are also presented to demonstrate the convergence property of the proposed IDMA-based MUD. This talk then provides results of comparison, in terms of multiple access channel (MAC) rate region, between the equal and unequal power allocation cases in the MUD scenario, as well as between the proposed BICM-ID-based IDMA and another IDMA technique that combines convolutional and a repetition codes for channel coding. It is shown that our proposed technique outperforms the counterpart technique, in terms of the rate pair in the MAC rate region.

(Schedule: Tuesday, 5 March 2013, 11:30–12:00)

EXIT Chart Aided Adaptive Permutation Control for Bit Interleaved Repetition Coded Cooperation

Bing YUAN , Shinsuke IBI, and Seiichi Sampei

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In this talk, we propose bit interleaved repetition coded (BIRC) cooperation scheme to obtain diversity effect without the space-time orthogonal code design. To solve the convergence problem of iterative detection involved in the proposed BIRC scheme, EXIT chart aided adaptive permutation control (APC) of bit interleaver is also introduced thereby optimizing the demapper curve for a specific channel realization and a specific channel decoder. The effectiveness of the proposed EXIT chart aided APC is validated both by trajectory analysis and FER/throughput evaluations.

(Schedule: Tuesday, 5 March 2013, 13:00–13:30)

Distributed Joint Source-Channel-Network Coding Exploiting Source Correlation for Multiple Access Relay Channel

Xiaobo Zhou, Khoirul Anwar and Tad Matsumoto

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We consider that problem of transmitting correlated binary sources over Multiple Access Relay Channel (MARC). A joint source-channel-network (JSCN) decoding technique is proposed to fully exploit the correlation between the sources, as well as the benefit of network coding. The achievable rate region and the theoretical limits of this system are derived by combining the Shannon and source coding with side information theorems.

(Schedule: Tuesday, 5 March 2013, 13:30–14:00)

An Energy-Efficient Multi-Access Relaying assisted by Joint Adaptive Network-Channel Coding

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A novel energy-efficient multiple access relay system is proposed in this paper where the accumulator (rate 1 recursive systematic code), equivalent to differential encoding, is fully exploited at source. The information estimates transmitted from the sources are extracted from the output of the differential detection (DD) and stored at relay. Destination first performs iterative decoding on the received signals transmitted from the sources in the different time slot. A joint adaptive network-channel coding (JANCC) technique is proposed and invoked if the received signals are decoded in error at the destination. In JANCC technique, the destination constructs a vector identifying the indexes of the sources whose information parts contain errors after decoding, and sent it back to the relay requesting a retransmission. The relay performs exclusive-OR (XOR) coding over the stored estimates of the sources, which may contain errors, specified by the identifier vector, and the XOR coded sequence is interleaved, re-encoded, and then transmitted to the destination as additional redundancy. A decoding scheme of JANCC is proposed at the destination where the Log-Likelihood Ratio is compensated by taking into account the error probability between the XOR coded sequence at the relay and the XORed information sequences of the sources flagged in the identifier vector. Simulation results show that frame error rate performance loss can be reduced to roughly 1–3 dB from the case where perfect decoding is assumed at the relay; however, the utilization of non-coherent and low-complexity detection strategy, compared with the perfect decoding assumed, at the relay, reduces roughly to 1/150 in computational complexity, which leads to significant power saving at the relay.

(Schedule: Tuesday, 5 March 2013, 14:00–14:30)

Outage Analysis Based Power Allocation: Slepian-Wolf Relay Viewpoint

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In the previous work, the outage probability of the correlated source transmission based on the Slepian-Wolf theorem has been derived, as well as the asymptotic tendency analysis. Then, an approximation method is used for the high SNR values to get the close-form of the outage expression. Based on this, an power allocation scheme is proposed for the Slepian-Wolf relay system, where the outage is minimized given the total transmitting power of both the source and the relay fixed.

(Schedule: Tuesday, 5 March 2013, 14:30–15:00)

Outage Probability Analysis of Correlated Sources Transmission over Rician Fading Channels

Shen Qian, Khoirul Anwar and Tad Matsumoto

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Theoretical outage probability analysis of a Slepian-Wolf transmission system with two distributed sources which can be described as bits-flipping model. The channel between one of the sources and destination is assumed to suffer from Rayleigh fading, while the channel between the other source and the destination is assumed to suffer from Rician fading. A double integral with respect to the probability density function (PDF) of the instantaneous signal-to-noise power ratios (SNRs) on admissible rate region of Slepian-Wolf theorem is used to calculate the outage probability. The outage performances show that the diversity order of the curves asymptotically plateau to one, depend on Rician fading factor K. It is also found that increasing LOS components of Rician channel can not always improve the outage performance with the condition that total transmission power of system is constant.

(Schedule: Tuesday, 5 March 2013, 15:00–15:30)

Doped-Accumulator Assisted Combining-after-Decoding Turbo Hybrid ARQ

Ade Irawan, Khoirul Anwar and Tad Matsumoto

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We propose a doped-accumulator assisted packet-combining-after-decoding technique with different doping rates per transmission phases for hybrid automatic repeat request (ARQ). Horizontal iteration (HI) performed for decoding the serially concatenated codes (SCC) is followed by Vertical iteration (VI) to exchange extrinsic log-likelihood ratio (LLR) of the uncoded (systematic) bits, and the *HI/VI* chain is repeated. The doped-accumulator enables the two extrinsic information transfer (EXIT) curves of the SCC to match very well and the convergence tunnel to open until a point very close to the (1.0,1.0) mutual information point. Excellent performance of our technique is verified through EXIT analysis as well as frame-error-rate (FER) and throughput simulations.

(Schedule: Tuesday, 5 March 2013, 16:00–16:30)

Estimation of Observation Error Probability in a Wireless Sensor Network

Xin He, Khoirul Anwar and Tad Matsumoto

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In this talk, we first of all propose for a parallel wireless sensor network (WSN) a decoding technique that well exploits the correlation knowledge of the sensing data to be transmitted from each sensor to the fusion center (FC). In this presentation, we derive an algorithm to estimate the observation error probabilities, representing the correlation, of the links between the sensing object and sensors. The convergence of the algorithm is also evaluated. Furthermore, the comparison of bit-error-rate (BER) performance between two cases, one uses estimated observation error probabilities, the other assumes the full knowledge of the observation error probabilities, is made. The simulation results show that the difference is only around 0.3-0.5 dB in per-link signal-to-noise power ratio (SNR), depending on the number of sensors.

(Schedule: Tuesday, 5 March 2013, 16:30–17:00)

Evaluation for Slepian-Wolf Relaying Systems using Field Measurement Data

Khoirul Anwar and Tad Matsumoto

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In Slepian-Wolf relaying systems, the correlation between source and relay is exploited so that the messages received at the relay, even though it contains error, still help the destination decodes correctly the message transmitted from the source node. In order to assess the practicality in real fields, in this presentation we evaluate the performance of the proposed relaying structure with a series of simulation using channel-sounding field measurement data.

(Schedule: Tuesday, 5 March 2013, 17:00–17:30)

On the Granular Gain of Lattices based on Linear Codes

Shingo Kawamoto and Motohiko Isaka

Kwansei Gakuin University, Osaka, Japan

Lattices for quantization play an important role in some transmission scenarios. In this study, we quantify the granular gain of low-dimensional lattices constructed from component codes over finite fields.

(Schedule: Wednesday, 6 March 2013, 10:40–11:10)

Convergence Constraint Multiuser Transmitter-Receiver Optimization in Single Carrier FDMA

Valtteri Tervo[1]*, Antti Tölli*[1]*, Juha Karjalainen*[1]*, and Tad Matsumoto*[2]

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[2]Japan Advanced Institute of Science and Technology (JAIST), Japan

This research investigates convergence constraint power allocation (CCPA) and receiver optimization in single carrier multiuser (MU) single-input multiple-output (SIMO) systems with iterative frequency-domain (FD) soft cancelation (SC) minimum mean-squared error (MMSE) equalization. In order to exploit full benefit of iterative receiver, convergence properties need to be considered. The proposed scheme can guarantee that the desired mutual information point/value after sufficient amount of iterations is achieved. We propose a successive convex approximation algorithm with two different approximations as a solving the non-convex convergence constraint power minimization problem. The results of EXIT-chart analysis demonstrate that the CCPA design can achieve the objectives described above. We will additionally present a low-complexity suboptimal structure based on the zero forcing (ZF) technique. Furthermore, numerical results will be presented to verify the analytical results and to show the performance of the proposed techniques.

(Schedule: Wednesday, 6 March 2013, 11:10–11:40)

Coordinated Linear Precoding in Downlink Multicell MU-MISO OFDMA Networks

Mirza Golam Kibria and Hidekazu Murata

Kyoto University, Japan

This work considers coordinated linear precoding for rate optimization in downlink multicell multiuser orthogonal frequency-division multiple access (OFDMA) network. We focus on two different design criteria. In the first, the weighted sum-rate (WSR) is maximized under per base station (BS) transmit power constraint. In the second, we minimize the total transmit power satisfying the signal-to-interference-plus-noise-ratio (SINR) constraints of the subcarriers per cell. Both problems are solved using standard conic optimization packages. A less-complex, fast and provably convergent algorithm that maximizes the WSR with per cell transmit power constraints is formulated. We approximate the nonconvex weighted sum-rate maximization (WSRM) problem with a solvable convex form by means of sequential parametric convex approximation (SPCA) approach. The second order cone formulations of objective function and constraints of the optimization problem are derived through proper change of variables, first order linear approximation and hyperbolic constraints transformation, etc. The algorithms converge to the suboptimal solutions taking less number of iterations in comparison to other known iterative rate optimization algorithms. Finally, numerical results are presented to justify the effectiveness and superiority of the proposed algorithm.

(Schedule: Wednesday, 6 March 2013, 11:40–12:10)

Design and Implementation of OFDMA Software Defined Radio

Trio Adiono

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Institut Teknologi Bandung (ITB), Bandung, Indonesia

OFDMA is one of current advanced Wireless Broadband Technology which is adopted by many broadband system. The OFDMA system involves a very complex digital signal and protocol processing. The improvement of this technology is also very fast. More over, a fast design cycle and easy of reconfigurability of this technology implementation is a great challenge. Therefore, we proposed a Software Defined Radio (SDR) based technology implementation which consist of reconfigurable hardware and software system. In this presentation we will explain the methodology of its implementation using SDR technology. The methodology covers from algorithm development, system simulation, hardware-software partitioning, system implementation, RF Design, radio conformance test and over the air test. The implementation result will be demonstrated in this presentation

(Schedule: Wednesday, 6 March 2013, 13:30–14:00)

Distributed Spatial Multiplexing Using Slepian-Wolf Coding

Nian Xie and Alister Burr

University of York, UK

In distributed spatial multiplexing a group of single-antenna terminals cooperates to communicate with another group of terminals, using spatial multiplexing principles to increase the overall data throughput compared to a single relay transmission scheme. Within the destination group the receiving terminals must forward the received signal to the final destination using minimal resources to do so. This presentation describes the use of Slepian-Wolf coding for distributed compression of the signals at the receiving terminals, exploiting the correlation of these signals. In particular it analyses the error floor that may arise due to errors at receiving terminals.

(Schedule: Wednesday, 6 March 2013, 14:00–14:30)

Network Coded Modulation for Random Channel Class in WNC with HDF Relaying Strategy

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Faculty of Electrical Engineering, Czech Republic

A standard NCM (Network Coded Modulation) for WNC (Wireless Network Coding) with HDF (Hierarchical Decode & Forward) strategy requires that each node has full knowledge of the connectivity pattern to other nodes and this knowledge affects the design of NCM and HNC (Hierarchical Network Code) maps at each transmitting (source) and receiving (relay) node respectively. The final destination has to have full knowledge of all HNC maps used and the composite overall HNC map needs to be invertible to recover the source data. This approach collapses if nodes do not have a full knowledge of the connectivity pattern and thus cannot adjust their HNC maps properly. We design the NCM and HNC maps for WNC with HDF strategy that works regardless of this knowledge. It is based on a concept of a channel class which is a discrete (random) parameter describing the channel behavior and which becomes a part of HNC maps and the NCM hierarchical constellation. We analyze the rate regions for this design and compare it to the standard NCM and HNC map solution suffering from random channel outages.