Editorial

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Space-time coding for multiple transmit and multiple receive antenna systems has recently attracted considerable attention in the wireless communications area. It has been shown theoretically that for certain channels the capacity of a multiple antenna system increases linearly with the number of antennas, which implies that multiple antenna systems have huge potential applications in broadband wireless communications. In a multiple antenna system, a key step is multiple antenna coding and modulation, called space-time coding. In single antenna systems, the coding and modulation only deals with one by one complex symbols or symbol sequences. However, in multiple antenna systems, the space-time coding deals with complex symbol matrices or matrix sequences.

In space-time coding, space-time code design is one of the most important topics. Unlike the conventional single antenna AWGN channel, the multiple antenna channel is a matrix instead of a scalar even in the simplest case.
So, the space-time code design is more challenging than in single antenna systems. Concerning a multiple antenna channel, i.e., a multi-input and multi-output (MIMO) system, there are two cases: the MIMO channel is known or unknown at the receiver. Since the channel is a complex matrix, signal processing may play an even more important role than it does in a single antenna system. When we deal with space-time matrices, the code size may be huge and therefore fast decoding algorithms are critically important.
As a result, space-time coding has become one of the most active research areas in wireless communications area. The EURASIP JASP has dedicated two issues to this active research area. The first issue has 11 papers that spread over space-time code designs, decoding methods of space-time coded channels, and MIMO systems.

The first three papers are on space-time code designs. The paper by S. M. Haas, J. H. Shapiro and V. Tarokh considers the space-time coding issues for wireless optical channels. The space-time codes are used to overcome turbulence-induced fading in an atmopspheric optical beterodyne communication system They propose a new criterion for the space-time code design for such channels. The paper by Z. Safar and

K. J. R. Liu considers a systematic space-time trellis code design method by jointly considering diversity and coding advantages. They propose to directly assign channel symbols to transmit antennas at different states by exploiting the properties of the state transitions in the trellis.
The paper by D. Tujkovic, M. Juntti and M. Latva-aho considers space-time turbo code designs. They propose a design method for recursive space-time trellis codes and parallel-concatenated space-time turbo coded modulation that can be applied to an arbitrary existing space-time trellis code. This method enables a large, systematic increase in coding gain while preserving the maximum transmit diversity gain and bandwidth efficiency property of considered space-time trellis code.

The next six papers are on decoding methods of space-time coded channels. The paper by B. A. Bjerke and J. G. Proakis considers the equalization of a multiple transmit and receive antenna wireless system. They consider uncoded, convolutionally coded, turbo coded MIMO channels, and also precoded MIMO channels. The paper E. Erez and M. Feder proposes new decoding techniques for diversity channels employing space-time codes when the channel coefficients are unknown to both transmitter and receiver. They propose an efficient implementation of the generalized maximum-likelihood ratio test algorithm and an energy weighted decoder. The paper by S. K. Jayaweera and H. V. Poor considers low complexity multiuser detection methods for space-time coded synchronous multiple-access systems in the presence of independent Rayleigh fading. They show that optimal space-time codes designed for single user channels can still provide full diversity in the multiuser channel. The paper by J. Liu, J. Li, and E. G. Larsson considers a differential space-time block code modulation for DS-CDMA systems. They propose three demodulation schemes namely differential space-time block code Rake receiver, differential space-time block code deterministic receiver, and differential space-time block code deterministic de-prefix receiver. The paper by Y. Liu and X. Wang proposes a space-time differential decoding technique based on multiple-symbol detection and decision-feedback by making use of the second-order statistics of the fading. The paper by J. Zhang and P. M. Djuric considers a joint estimation and decoding of space-time trellis codes by employing a new emerging tool in statistical signal processing, sequential importance sampling.

The final two papers are on MIMO systems. The paper by A. Grant considers information theoretic properties of flat fading channels with multiple antennas when the perfect channel knowledge at the receiver is assumed. expressions for maximum information rates and outage probabilities are derived.
It is shown that the use of orthogonal modulating signals is asymptotically optimal in terms of information rate. The paper by T.-L. Tung and K. Yao considers the problem of channel estimation and optimal power allocation for a multiple=antenna OFDM system. They develop a least-square channel channel estimation approach, derive the performance bound, investigate the optimal training sequence for initial channel acquisition, and derive the optimal power allocation solution that maximizes the badwidth efficiency under the power and QOS constraints.