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Editorial

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There has been an explosion of research interest during the past decade in multiantenna wireless communications systems due to their promise for increased throughput and reliability. Initial work on these multiple-input multiple-output (MIMO) systems focused on single-user, point-to-point links, where interference is modeled generically and resource allocation issues can be ignored. More recently, increased attention has been given to multiuser problems, where one or more network nodes possess multiple antennas. This represents a generalized MIMO problem, where the multiple inputs could be from an antenna array at a single location, from single antennas at different locations, or from multiple antenna arrays at multiple points. Similarly, the multiple outputs could be arranged in any of these configurations as well. Once the spatial resources of the channel must be shared among several users, issues such as interference cancellation, power allocation, scheduling, source separation, and multiuser detection arise. The interplay of these problems with standard MIMO topics such as space-time coding, beamforming, channel estimation, and capacity provide for an extremely rich array of research directions.

The papers that appear in this special issue reflect the variety of problems that must be addressed in a multiuser MIMO communications network. The first three papers (Popescu and Rose, Pascual-Iserte et al., Zhang and Dai) address system-level optimization when channel state information (CSI) is available at all points in the network. Maximizing or achieving a minimum acceptable signal-to-interference-plus-noise ratio (SINR) for every network link is shown to require proper coordination of transmitted power and joint transmit/receive beamformer design. The next three papers (Spencer and Swindlehurst, Pan et al., Biguesh et al.) are similar in spirit, but specifically focus on the downlink problem, where one or more base stations attempt to simultaneously communicate with multiple cochannel users. Again, power control and joint beamformer design are the keys. At this point, the special issue shifts to considerations of the capacity of the multiuser uplink. Jorswieck and Boche study capacity under various worst-case assumptions on the noise, and develop corresponding optimal uplink transmit strategies. Serbetli and Yener investigate approaches for scheduling uplink transmissions and uplink transmit beamformer design in order to maximize the sum capacity. Hämäläinen et al. discuss the coverage and capacity gains of multiuser MIMO techniques for the specific case of UMTS terrestrial radio access systems. Veselinovic et al. report on the application of turbo equalization and multiuser detection techniques for uplink user signal separation. Finally, all of the above papers assume the availability of CSI, but they do not discuss how this is to be achieved. This very important problem is the topic of the paper by Sung et al., which describes how to exploit the structure of space-time encoded CDMA signals for blind channel estimation.

We would like to thank the many individuals who participated in the review process of this special issue; their efforts have led to considerable refinement of the papers and to greatly improving the issue's overall quality. We appreciate the efforts of the authors not only in producing interesting and informative papers, but also in keeping up with our submission and revision timeline. Finally, we express

appreciation to Hindawi Publishing for their support in helping to make this special issue a reality. Ultimately, we hope that the papers and references listed in this special issue will spark continued interest in what is a very exciting research area.

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A. Lee Swindlehurst received the B.S. and M.S. degrees in electrical engineering from Brigham Young University (BYU) in 1985 and 1986, respectively, and the Ph.D. degree in electrical engineering from Stanford University in 1991. From 1986 till 1990, he was employed at ESL, Inc., Sunnyvale, Calif, where he worked on the design of algorithms and architectures for radar and sonar signal processing systems. He joined the faculty of the Department of Electrical and Computer Engineering, BYU, in 1990, where he is a Full Professor and is currently serving as Department Chair. During 1996–1997, he was a Visiting Scholar at both Uppsala University and the Royal Institute of Technology, Sweden. His research interests lie primarily in the application of sensor array signal processing to radar and wireless communications problems. Dr. Swindlehurst is a Fellow of the IEEE, is currently serving as a Member of the Editorial Board for the EURASIP Journal on Wireless Communications and Networking, and is a former Associate Editor for the IEEE Transactions on Signal Processing. He is a recipient of the 2000 IEEE W.R.G. Baker Prize Paper Award, and is the coauthor of a paper that received the IEEE Signal Processing Society Young Author Best Paper Award in 2001.

Robert F. H. Fischer received the Dr.-Ing. degree in 1996, and the Habilitation degree in 2001, all from the University of Erlangen-Nürnberg, Erlangen, Germany. The subject of his dissertation was multichannel and multicarrier modulation, and that of his habilitation was precoding and signal shaping. Form 1992 to 1996, he was a Research Assistant at the Telecommunications Institute, University of Erlangen-Nürnberg. During 1997, he was with the IBM Research Laboratory, Zürich, Switzerland. In 1998, he returned to the Telecommunications Institute II, University of Erlangen-Nürnberg. Currently, he teaches graduate courses in digital communications. His research concentrates on fast digital transmission including single- and multicarrier modulation techniques. His current interests are in information theory, coded modulation, digital communications and signal processing, and especially precoding and shaping techniques for high-rate transmission schemes. Dr. Fischer received the Dissertation Award from the Faculty of Engineering, University of Erlangen-Nürnberg, in 1997, the Publication Award of the German Society of Information Techniques (ITG) in 2000, and the Wolfgang-Finkelnburg Habilitation Award in 2002. He is the author of the textbook *Precoding and Signal Shaping for Digital Transmission* (John Wiley & Sons, New York, 2002).

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