JOINT PHYSICAL AND NETWORK LAYER OPTIMISATION OF WIRELESS SYSTEMS: SMART ANTENNAS, TURBO CODING, SPACE-TIME CODING, ADAPTIVE TRANSCEIVERS AND 'ALL THAT' FOR IMPROVED QOS

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This overview is based on an amalgam of the Wiley/IEEE Press monographs [1]-[5]. The short course provides an insight into the effects of turbo-coded, turbo-equalised and space-time coded adaptive TDMA, CDMA and OFDM transceivers as well as smart antennas and a range of other efficient networking techniques on the achievable teletraffic capacity of adaptive wireless systems.

This research-oriented presentation considers the joint benefits of both adaptive physical and adaptive network-layer performance enhancement techniques. More specifically, conventional systems would drop a call in progress, if the communications quality falls below the target quality of service and it cannot be improved by handing over to another physical channel. By contrast, the adaptive transceivers of the near future are expected to simply 'instantaneously drop the throughput, rather than dropping the call' by reconfiguring themselves in a more robust mode of operation. It is demonstrated that the proposed beam-forming and adaptive transmission techniques may double the expected teletraffic capacity of the system, whilst maintaining the same AVERAGE performance as their conventional fixed-mode counterparts.

Whilst this overview is ambitious in terms of providing a research-oriented outlook, potential attendees require only a modest background in wireless communications. Network operators, service providers, managers and researchers embarking on the joint optimisation of the physical and network layer may find the coverage of the presentation beneficial. The participants will receive a set of slides as supporting material.

1. REFERENCES

[1] L. Hanzo, T.H. Liew, B.L. Yeap: Turbo Coding, Turbo Equalisation and Space-Time Coding, John Wiley, August 2002, ISBN 0-470-84726-3, **766 pages**

[2] L. Hanzo, C.H. Wong, M.S. Yee: Adaptive wireless transceivers: Turbo-Coded, Turbo-Equalised and Space-Time Coded TDMA, CDMA and OFDM systems, John Wiley, March 2002, ISBN 0-470-84689-5 **752 pages**

[3] J.S. Blogh, L. Hanzo: Third-Generation Systems and Intelligent Wireless Networking - Smart Antennas and Adaptive Modulation, John Wiley, April 2002, ISBN 0-470-84519-8 **430 pages**

[4] L. Hanzo, M. Münster, B.J. Choi and T. Keller: OFDM and MC-CDMA for Broadband Multi-user Communications, WLANs and Broadcasting, John Wiley - IEEE Press, July 2003, **980 pages**

[5] L. Hanzo, L-L. Yang, E-L. Kuan and K. Yen: Single- and Multi-Carrier DS-CDMA: Multi-User Detection, Space-Time Spreading, Synchronisation, Standards and Networking, IEEE Press - John Wiley, August 2003, **1060 pages** [1]

The lecturer of this course is **Lajos Hanzo**. During his 27-year carreer he has held various academic and research positions in Hungary, Germany and the UK. Since 1986 he has been with the University of Southampton, where he holds the Chair of Telecommunications. Over the years he has co-authored 10 books on mobile radio communications, published in excess of 450 research papers and has been awarded a number of distinctions. He is an IEEE Distinguished Lecturer. For further information on research in progress and for associated papers and book chapters please refer to http://www-mobile.ecs.soton.ac.uk

[1] For sample chapters and full contents of these books please refer to http://www-mobile.ecs.soton.ac.uk

Spaceâ€“time block coding is a technique used in wireless communications to transmit multiple copies of a data stream across a number of antennas and to exploit the various received versions of the data to improve the reliability of data transfer. The fact that the transmitted signal must traverse a potentially difficult environment with scattering, reflection, refraction and so on and may then be further corrupted by thermal noise in the receiver means that some of the received copies of the data may Space-time coding is an effective transmit diversity technique to combat fading in wireless communications. Space-time codes are a highly bandwidth-efficient approach to signalling within wireless communication that takes advantage of the spatial dimension by transmitting a number of data streams using multiple co-located antennas. There are various approaches to the coding structures, including space-time trellis coded modulation, space-time turbo codes and also layered architectures. The central issue in all these various coding structures is the exploitation of multipath effects in order to Space-time block codes are designed to achieve the maximum diversity order for a given number of transmit and receive antennas subject to the constraint of having a simple decoding algorithm. The classical mathematical framework of orthogonal designs is applied to construct space-time block codes.Â For the specific cases of two, three, and four transmit antennas, space-time block codes are designed that achieve, respectively, all, 3/4, and 3/4 of maximum possible transmission rate using arbitrary complex constellations.Â Joint Physical and Network Layer Optimisation of Wireless Systems: Smart Antennas, Turbo Coding, Spa L. Hanzo. Read more.