Near-Capacity Wireless Multimedia System Design: Error-Resilient Source-Compression, Multi-Functional MIMOs and Efficient Streaming

Abstract: Most multimedia source signals are capable of tolerating lossy, rather than lossless, delivery to the human eye and ear, since the audio-visual impairment-masking properties of the human 'receiver' may be exploited. Hence the coding-induced impairments may be rendered almost imperceptible. The standardized multimedia source codecs however exhibit unequal error sensitivity, which is not the case for Shannon's ideal entropy codec. In this research-review, a unified treatment of near-capacity multimedia communication systems is offered, where we focus our attention not only on source and channel coding aspects but also on their iterative decoding, streaming and transmission problems. The design examples considered include cutting-edge near-capacity variable-length codes, multi-layer video streaming systems supported by multi-functional antenna arrays (MFAA) and three-stage concatenated receivers.

- Shannonian lessons on multimedia communications - is the source- and channel-coding separation theorem still valid for the high-compression multimedia codecs of the 21st century?
- Audio/video compression basics, video standards and multi-layer coding
- Iterative detection and Extrinsic Information Transfer (EXIT) charts
- Near-capacity variable-length codes for multimedia communications
- How closely can we approach capacity and what is the price of it?
- Audio/video streaming and Multi-Functional Antenna Arrays (MFAA)
- The benefits of short block codes, unity-rate codes and three-stage concatenated transceivers

The tutorial is based on:

- **Video compression basics**: L. Hanzo, P. Cherriman, and J. Streit: *Video Compression and Communications: H.261, H.263, H.264, MPEG4 and Proprietary Codecs as well as HSDPA-Style Adaptive Turbo-Transceivers*, John Wiley and IEEE Press.
- **Audio compression basics:** L. Hanzo, F.C.A. Somerville, and J. P. Woodard: V*oice and Audio Compression for Wireless Communications*, John Wiley and IEEE Press.
- **Inter-layer FEC aided unequal error protection for multi-layer video transmission:** Y. Huo, M. El-Hajjar, and L. Hanzo, "Inter-layer FEC aided unequal error protection for multi-layer video transmission in mobile TV," *IEEE Trans. on Circuits and Syst. for Video Technol.*, 2013, pp 1622-1634.
- **Multi-layer and multi-view video coding:** Y. Huo, M. El-Hajjar, R. G. Maunder, and L. Hanzo, "Layered wireless video relying on minimum-distortion inter-layer FEC coding," *IEEE Trans. on Multimedia*, 2014, pp 697-710.
- **Distributed multi-view video coding:** Y. Huo, T. Wang, R. G. Maunder, and L. Hanzo, "Motion-aware mesh-structured trellis for correlation modelling aided distributed multi-view video coding," *IEEE Trans. on Image Processing*, 2014, pp 319-331.
- **Cooperative joint source and channel coding: A. J.** Aljohani, S. X. Ng, R. G. Maunder, and L. Hanzo, "EXIT-chart aided joint source-coding, channel-coding and modulation design for two-way relaying," *IEEE Trans. on Vehicular Technology*, 2013, pp 2496-2506.

Presenter: Lajos Hanzo, University of Southampton (UK)

Lajos Hanzo (http://www-mobile.ecs.soton.ac.uk) Royal Society Wolfson Fellow, FREng, FIEEE, FIET, EURASIP Fellow, DSc, "Doctor Honoris Causa" has held various research and academic posts in Hungary, Germany and the UK. Currently he holds the Chair in Telecommunications at the University of Southampton, UK, where he has successfully supervised about 100 PhD students, co-authored 20 John Wiley/IEEE Press books, published 1400+ research entries at *IEEE Xplore*, acted both as TPC and General Chair of IEEE conferences, presented keynote lectures and has been awarded a number of distinctions. He is also a Governor of the IEEE VTS. During 2008 - 2012 he was the Editor-in-Chief of the IEEE Press and a Chaired Professor also at Tsinghua University, Beijing.