

IEEE KW Section Vehicular Technology Chapter Distinguished Lecture

HARNESSING QUANTUM-COMPUTING & SIGNAL PROCESSING IN WIRELESS COMMUNICATIONS

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Abstract

Since Marconi demonstrated the feasibility of radio transmissions, researchers have endeavoured to fulfill the dream of flawless wireless multimedia telecommunications, creating the impression of tele-presence - at the touch of a dialling key...

However, making this dream a reality required 'quantum' leaps both in digital signal processing and in its nano-electronics based implementation, facilitated by advances in science both in Edinburgh and farther afield. This process has been fuelled by a huge consumer market. Moore's laws has indeed prevailed since he outlined his empirical rule-of-thumb in 1965, but based on this the scale of integration is set to depart from classical physics obeying the well-understood rules revealed by science and enter into a new world, where the traveller has to obey the sometimes strange new rules of the quantum-world.

The quest for quantum-domain communication solutions was inspired by Feynman's revolutionary idea in 1985: particles such as photons or electrons might be relied upon for encoding, processing and delivering information. During the last three decades researchers and engineers often considered a pair of open problems. Firstly, classic systems relying on the efficient processing capability of quantum-search algorithms were considered in the area of quantum-assisted communications, while the branch of quantum-domain communications relies on quantum channels.

In wireless communications we often encounter large-scale search problems, some of which may be efficiently solved with the aid of bio-inspired random guided algorithms or quantum-search techniques. For example, Grover's algorithm is capable of searching through an N -element data-base with the aid of \sqrt{N} cost-function evaluations. Commencing with a brief historical perspective, a variety of efficient quantum-assisted solutions will be exemplified.



Lajos Hanzo FEng, FIEEE, FIET, RS Wolfson Fellow, received his 5-year Master degree in electronics from the Technical University of Budapest in 1976, his doctorate in 1983 and his Doctor of Sciences (DSc) degree in 2004. During his career in telecommunications he has held various research

and academic posts in Hungary, Germany and the UK. Since 1986 he has been with the School of ECS, University of Southampton, UK, where holds the Chair in Telecommunications. His current research interests are featured at (<http://www-mobile.ecs.soton.ac.uk>)

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LOCATION: EIT 3142, University of Waterloo

Invited by Professor Weihua Zhuang