Special Issue on Quantum Communications – Guest Editorial

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THIS is the first time when Infocommunications Journal has a special issue on quantum communications. This year's Nobel Prize in Physics winners, David J. Wineland and Serge Haroche had a great contribution in the way to a working quantum computer. Although these computers are going to be the applications of the far future, there are already a few algorithms to solve problems which are very difficult to handle with traditional computers. Quantum computing is based on various quantum effects in physics and offers revolutionary solutions for different problems e.g., prime factorization, searching in unsorted database, key distribution and information coding. The power of quantum parallelism allows us to solve classically complex problems, and the quantum entanglement leads to quantum communication algorithms like teleportation and superdense coding. The quantum cryptography provides new ways to transmit information with unconditional security by using different quantum key distribution protocols

In this Special Issue on Quantum Communications of the Infocommunications Journal, three selected papers highlight the different directions and problems of the quantum communications.

Deep-space optical communication is a key component of the NASA roadmap, with the goal of returning greater data-volumes from Mars and other solar-system encounters in future missions. Conventional optical receivers currently under consideration for deep-space communications employ photon-counting or coherent detection to potentially extract useful information even from a single photon, on the average. However, while quantum mechanics promises greater gains, it fails to specify how these theoretical gains can be achieved in practice. *Quantum Receiver for Binary Coherent-State Signals with Constant-Intensity Local Lasers* by Victor A. Vilnrotter describes the quantum receiver for this type of communication. According to their results, the new receiver concept can be implemented using practical measurements amenable to high data-rate operation, hence it may enable future deep-space optical communications with performance approaching the greatest possible fidelity allowed by the laws of quantum mechanics.

There is a growing interest in providing and improving radio coverage for mobile phones, short range radios and WLANs inside buildings. The recently published methods use any heuristic techniques for finding the optimal Access Point (AP) positions. The *Classical and Quantum Genetic Optimization Applied to Coverage Optimization for Indoor Access Point Networks* by Lajos Nagy introduces the Quantum inspired Genetic Algorithm (QGA) for indoor access point position optimization to maximal coverage and compares with the Classical Genetic Algorithm (CGA).

The Problem of Testing a Quantum Gate by Subhash Kak deals with a problem that has no analogy in the classical world. To test a quantum gate we need certified quantum gates to generate all possible inputs and since such gates are not available at this time how are we going to certify a gate that has been submitted for certification? In the paper, the authors consider the question of testing of quantum gates as a part of the larger problem of communication through circuits that use a variety of such gates.

LÁSZLÓ BACSÁRDI obtained M.Sc. degree in computer engineering at Budapest University of Technology and Economics (BME) in 2006. He holds an associate professor position at the University of West Hungary, where he is the Head of the Institute of Informatics and Economics. He wrote his PhD thesis on the possible connection between space communications and quantum communications at the BME Department of Telecommunications in 2012. His current research interests are in mobile ad hoc communication, quantum computing and quantum communications. He is the Secretary General of the Hungarian Astronautical Society (MANT), which is the oldest Hungarian non-profit space association founded in 1956. He is member of the board of a Hungarian scientific newspaper ('World of Nature') and he is the publisher of a non-profit Hungarian space news portal ('Space World'). Furthermore he is member of IEEE, AIAA and the HTE. He has joined the Space Generation Advisory Council (SGAC) as well, currently active as the Hungarian National Point of Contact.

SÁNDOR IMRE was born in Budapest in 1969. He received the M.Sc. degree in Electrical Engineering from the Budapest University of Technology (BME) in 1993. Next he started his Ph. D. studies at BME and obtained dr. univ. degree in 1996, Ph.D. degree in 1999 and DSc degree from the Hungarian Academy of Sciences in 2007. Currently he is carrying his activities as Professor and Head of Dept. of Telecommunications. He is chairman of Telecommunication Scientific Committee of the Hungarian Academy of Sciences. He participates the Editorial Board of two journals: Infocommunications Journal and Hungarian Telecommunications. He was invited to join the Mobile Innovation Centre as R&D director in 2005. His research interest includes mobile and wireless systems, quantum computing and communications. Especially he has contributions on different wireless access technologies, mobility protocols, security and privacy, reconfigurable systems, quantum computing based algorithms and protocols.

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