IEEE Access
Multidisciplinary | Rapid Review | Open Access Journal

Date of current version March 12, 2018.

Digital Object Identifier 10.1109/ACCESS.2018.2805578

EDITORIAL

IEEE ACCESS SPECIAL SECTION EDITORIAL: NANO-ANTENNAS, NANO-TRANSCEIVERS AND NANO-NETWORKS/COMMUNICATIONS

Nanotechnology is enabling the development of devices on a scale ranging from one to a few hundred nanometers. At this scale, novel nanomaterials and nanoparticles show new properties and behaviors not observed at the microscopic level. In the future, networks of nano-devices will be a key component of almost every field of our society, with applications in biomedicine, environmental protection, entertainment, homeland security, and beyond. In order to enable nano-devices to communicate with each other, many fundamental challenges need to be addressed. As the functional devices shrink into nano-scale, design, fabrication and control of the systems impose novel design principles which greatly differ from that of the macro. Electromagnetic (EM) communication in the Terahertz (THz) band (0.1–10 THz) enabled by graphene-based plasmonic nano-transceivers and nano-antennas has been suggested as one of the possible approaches for communication among these devices. This Special Section in IEEE ACCESS is dedicated to all aspects of nanoscale communications including transceiver and antenna design in addition to communication and networking solutions, as well as novel paradigm, e.g., Hybrid Molecular/EM communication systems.

This Special Section consists of six article contributions covering a variety of topics in line with the Call for Papers:

In (invited article) ''Modeling and performance analysis of metallic plasmonic nano-antennas for wireless optical communication in nanonetworks'' by Mona Nafari et. al., the authors modeled metallic plasmonic nano-antennas for wireless optical communication. They developed a mathematical framework to investigate the performance in transmission and reception of metallic nano-dipole antennas and validated the analytical model by means of simulations with COMSOL Multi-physics. This developed framework will guide the design and development of novel nano-antennas suited for wireless optical communication.

In (invited article) ''Cooperative in-vivo nano-network communication at terahertz frequencies'' by Qammer H. Abbasi et. al., the authors present, a novel concept of cooperative communication for in-vivo nano network in order to the communication among nano devices. System outage probability performance is conducted for various parameters including relay placement, number of relays etc. and results show approximately a 10-fold increase in the system outage performance, hence shows a great potential of using cooperative communication to enhance the performance of nano-network.

In ''EOC: Energy optimization coding for wireless nanosensor networks in the terahertz band'' by Long-Jun Huang et. al., the authors presented an energy efficiency coding for nano-sensor which is critical issue for wireless nano sensor networks (WNSNs). Based on the optimal source-word length and the optimal code-word length by solving an energy optimization problem, an energy efficient coding scheme and the corresponding coding algorithm are presented. Simulation results show that EOC performs more energy efficiently than the existing nanonetwork minimum energy coding while requiring a smaller source-word length.

In the second invited article ''Terahertz band intra-chip communications: Can wireless links scale modern x86 CPUs?'' by Vitaly Petrov et. al., the authors performed the scalability study of x86 CPU design that is backward compatible with the current x86 architecture and showed that preserving the current cache coherence protocols mapped into the star wireless communications topology that allows for tight centralized medium access control a few hundreds of active cores can be efficiently supported without any notable changes in the x86 CPU logic. This important outcome allows for incremental development, where THz-assisted x86 CPU with a few dozens of cores can serve as an intermediate solution, while the truly massive multi-core system with broadcast-enabled medium access and enhanced cache coherence protocols can be an ultimate goal.

In ''Computing and communications for the software-defined metamaterial paradigm: A context analysis'' by Sergi Abadal et. al., the authors give a clear review of Software-Defined Metamaterials (SDMs), which are a much sought-after paradigm shift and their enabling requires the integration of a network of controllers within the structure of the metamaterial. The design approach for such controllers and the interconnection network, however, remains unclear. To bridge this gap, this article aims to provide a context analysis from the computation and communication perspectives. Then, analogies are drawn between the SDM scenario and other applications both at the

micro and nano scales, identifying possible candidates for the implementation of the controllers and the intra-SDM network.

In the final article of the Special Section, "Collagen analysis at terahertz band using double-Debye parameter extraction and particle swarm optimisation" by Ke Yang et. al., the authors focus on the analysis of cultivated collagen samples at the terahertz (THz) band using double Debye model parameter extraction. Based on measured electrical and optical parameters, authors proposed a model to describe such parameters extracted with Particle Swarm Optimisation (PSO). Results of article show that cultivated collagen is not sufficient to represent the performance of the epidermis layer of the skin tissue at the THz band of interest.

These articles provide a good overview of current research and development activities going on in the selected areas of nano-communication. The editors hope that this Special Section in IEEE ACCESS will benefit the scientific community and contribute to the knowledge base.

ACKNOWLEDGMENTS

The editors would take this opportunity to applaud the contribution of the authors to this special issue. Efforts of the reviewers to enhance the quality of the manuscripts is also much appreciated.

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