Martedì 18 maggio 2021 ore 9:15

Safe, Sustainable and Low-cost Electromagnetic Technologies for the Internet of Things

Luciano Tarricone

Università di Lecce

ABSTRACT: Research and industrial activities related to the Internet of Things (IoT) are growing up faster and faster, and the related enabling technologies play nowadays a very important role. Most of these technologies are electromagnetic (EM). In this talk, we focus on some of the most important EM enabling technologies for the IoT and smart systems, discussing more specifically about 1) energy autonomy 2) identification 3) sustainability in terms of costs and safety related to human exposure to EM fields.

In the area of energy autonomy, two important issues are i) the design of systems and devices for Wireless Power Transmission (WPT) and ii) EM energy harvesting. The discussed research activities are related both to the design of low-power long-range links based on the use of rectennas (rectifying antennas) and to the design of high-power mid/low-range links based on the use of magnetically coupled resonant systems. A particular attention will be dedicated to the design of WPT links for wearable and implantable devices, especially in biomedical applications. As per WPT for wearable and portable devices, the focus is on the design of devices and systems fabricated by using non-conventional materials (conductive fabrics, textile materials, etc.). Further activities are related to the theoretical analysis of resonant energy links implemented by using either a capacitive or an inductive coupling. Useful design formulas will be proposed for links using multiple transmitters and/or multiple receivers and for multi-hop links.

As for identification, the reference enabling technology is of course RadioFrequency Identification (RFID). Design, prototyping and characterization of innovative tag and reader devices is addressed in a variety of applications. A dedicated attention is paid to the integration between RFID systems and sensors and, more in general, to the design of fully passive tags with *augmented* capabilities, such as sensing, reasoning, and alerting, capable to render “smart” the objects they are applied to. Some new and appealing perspectives opened by textile chipless tags will also be discussed.

As for the sustainability in terms of costs, safety and environmental issues, the proposed solutions are extremely effective. More specifically, for sustainability in terms of safety related to human exposure to EM fields, specific research is performed, and will be discussed in the talk, ranging from the use of microdosimetric bioelectromagnetic models at cell membrane levels (and even smaller scales), to the use of dosimetric numerical models (usually based on Finite-Difference Time-Domain -FDTD- methods) so to attack and solve the complex and critical issue of human interactions with EM fields generated by wireless systems.

LINK Teams: https://bit.ly/3ogcyEm