Method for Maximum Microwave Wireless Power Transmission considering Human Safety

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Microwave wireless power transmission (MPT) has been researched for a long time and is nowadays attracting more and more attention due to wide use of wireless devices such as mobile phones, internet of thing (IoT) devices, sensors and implant devices [1]. Various types of MPT have been studied theoretically and experimentally [2]-[5]. The goal in the MPT research is to transfer the maximum power from transmitter to receiver. In general, time-reversal (TR) is the best solution of MPT even in practical case with the maximum efficiency if there is no consideration of EMF issue. EM wave causes thermal heating in body and may results in hazard to human. Therefore, Specific absorption rate (SAR) is used to limit EM wave exposure to human body. Especially, the usage of MPT system close to the body makes it more dangerous than other wireless devices since MPT uses high power in transmitter. Therefore, human safety must be considered during the design process of MPT system.

In this presentation, a convex optimization algorithm that can control the field in body not to exceed SAR regulation and transfer maximum power to receiver is explained. The proposed algorithm is applied to several MPT scenarios with multiple transmitting antennas and one receiver near a box-shaped phantom model. A full-wave numerical simulation is used to compare the performance, the received power and the power efficiency, of the proposed optimization (OPT) technique with TR technique. The performance of OPT technique with various scenarios are analyzed and it is shown that the MPT system transfers more power to receiver than TR in every scenario.

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