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CWA modeling of a matching layer in a on-body coupling system

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The electromagnetic field generated by a radio frequency source, such as an antenna, can be transmitted inside biological tissues for various applications such as disease treatment and non-invasive imaging. Indeed, in the recent years research in the field of implantable antennas for continuous wireless health control of patients is motivated by promising advantages in terms of social and economic impact. In this framework, can be of importance to facilitate the penetration of the electric field in the tissues. In [1] the authors have investigated the role of small objects that may be close to a wearable or implantable antenna, as neklaces, buckles or buttons. In the frame of short-medium range wireless communication links, the work aims at providing a tool useful to find the field scattered by small dielectric targets, like buttons or other wearable objects, and partially transmitted to a receiving antenna placed inside, or inserted in close proximity to, an underlying human body simulated by a biological medium. A scattering problem was considered in which a configuration consisting of a set of dielectric scatterers placed over a multilayer medium is taken into account, providing a solution through the Cylindrical Wave Approach (CWA) [2]. An analytical approach is developed to solve the scattered field by the cylindrical scatterers in each medium through expansions into cylindrical waves, expressed through plane-wave spectra. The source of the scattering problem is a plane-wave and the dielectric cylinders simulate simple, ad-hoc objects that can be easily located on textile fabrics worn by a patient, in order to increase the power transfer to a wearable/implantable device. In this contribution, a case [3] where the scatterers are placed above a multilayer which models biological tissues in which an implantable antenna is integrated in the silicon header of a pacemaker inside the muscle layer is presented (see Fig. 1). The frequency considered in this contribution is 2.4 GHz. Shielding or electric field intensification effects are explored.

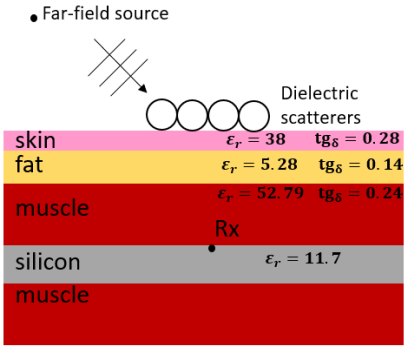

Figure 1. Geometry of the scattering problem

References

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