EFFECTIVE COMPLEX CONDUCTIVITY OF PERIODIC FIBROUS COMPOSITES WITH INTERFACIAL IMPEDANCE AND APPLICATIONS TO BIOLOGICAL TISSUES

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A simple analytical expression for the effective complex conductivity in the radio frequency range of a biological tissue comprised by cylindrical cells, such as skeletal muscle, is presented. The tissue is modeled as a periodic square arrangement of conductive circular cylinders embedded in a conductive matrix, with imperfect interfaces exhibiting a capacitive impedance, accounting for the dielectric behavior of cell membranes. The problem solved herein is formally analogous to the antiplane shear problem of a periodic fibrous composite with linearly elastic constituents and Kelvin-Voigt viscoelastic interfaces. The asymptotic homogenization method is adopted, and the local problem is solved by resorting to the complex variable theory and Weierstrass elliptic functions, suitably exploited in order to deal with the imperfect-interface condition.