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**Analytical model of induced transmembrane potentials in cells and organelles** VIJAYANAND VAJRALA , Department of Physics and Texas Center for Superconductivity, University of Houston, JAMES CLAYCOMB, Department of Mathematics and Physics, Houston Baptist University, JOHN H. MILLER, JR., Department of Physics and Texas Center for Superconductivity, University of Houston — Oscillatory electric fields cause morphological and functional changes in biological cells by perturbing the resting potentials across the cell and organelle membranes. Although much work has been reported on ac field induced transmembrane voltages in cells, this has mainly been limited to the plasma membrane. We have developed a three-membrane analytical model describing the plasma membrane surrounding inner and outer mitochondrial membranes. Frequency dependent induced plasma and mitochondrial membrane potentials are calculated with mobile interfacial charges on either side of the membranes. The dependence of the induced membrane potentials on the membrane conductivity and permittivity is also calculated. A finite element electromagnetic model is used to calculate the induced mitochondrial membrane potentials for arbitrary geometries with axial symmetry. Modeling results are compared to nonlinear harmonic response measurements of cells and isolated mitochondria exposed to ac electric fields.

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