Microdosimetry modeling technique for spherical cell

Abstract:

Electroporation is a process of the bio-physical effect on cells exposed to an external electrical field is gaining applications in medical treatments, especially to create pores through a cell membrane and allow uptake of DNA into a cell. The efficacy of this treatment depends on the magnitude and the distribution of electric field applied, in addition to the physiological parameters, such as the conductivities and relative permittivities of the cell membranes and cytoplasm. In addition, physical parameters, such as the thickness and size of the cell also influence the efficiency of the electroporation technique. In this research, the electric field distributions of spherical cells were studied using Finite Integration Techniques (FIT), to explicate the difference in responses of the analytical and numerical cells for a given input voltage. For this purpose, quasistatic approach based on CST EM STUDIO® software was used. A comparison of the induced transmembrane potential of the analytical against numerical technique shows that not more than 2% was observed in the spherical cell for an applied field of 1V/m to 10nm thick cell membranes.