Computational method for frequency dependent potentials in cell-suspension model

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ABSTRACT

The frequency difference EIT requires to study the forward problem for a single cell suspension model entering the equation $\nabla\cdot((\sigma+i\omega\epsilon)\nabla u) = 0$ in the presence of a thin insulating membrane with its thickness $d \approx 0$. We try to investigate behavior of the potential u near the membrane with changes of ω and d. The major difficulty in numerical simulations comes from the fact that the potential u changes abruptly across the membrane and its frequency differential $\frac{\partial u}{\partial \omega}$ depends heavily on the thickness d. Hence, as $d \to 0$, the standard finite element method may not be appropriate since it requires fine mesh along the very thin membrane. To deal with this problem, we employ a special numerical technique with regarding $d = 0$; a jump discontinuity of the potential across the membrane is imposed with taking account of d, ω, and the interaction between the real and imaginary part of u. This new computation model combined with a special iteration scheme enable to compute the potential effectively. We perform various numerical simulations to demonstrate the proposed method.

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