

Numerical Simulation of Phase Transfer during Cryosurgery for an Irregular Tumor Using Hybrid Approach

Authors : Rama Bhargava

Abstract : In the current paper, numerical simulation has been performed for the two-dimensional time dependent Pennes' heat transfer model which is solved for irregular diseased tumor cells. An elliptic cryoprobe of varying sizes is taken at the center of the computational domain in such a manner that the location of the probe is fixed throughout the computation. The phase transition occurs due to the effect of probe with infusion of different nanoparticles Au, Al₂O₃, Fe₃O₄. The cooling performance of these nanoparticles injected at very low temperature, has been studied by implementing a hybrid FEM/EFGM method in which the whole domain is decomposed into two subdomains. The results are shown in terms of temperature profile inside the computational domain. Rate of cooling is obtained for various nanoparticles and it is observed that infusion of Au nanoparticles is very much efficient in increasing the heating rate than other nanoparticles. Such numerical scheme has direct applications where the domain is irregular.

Keywords : cryosurgery, hybrid EFGM/FEM, nanoparticles, simulation

Conference Title : ICCAM 2022 : International Conference on Computer and Applied Mathematics

Conference Location : Istanbul, Türkiye

Conference Dates : June 27-28, 2022