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Thermotherapy simulations in composite tissues

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The author wants to present a mathematical base approaches for the simulation of thermal therapy. This method is useful in surgical procedures for selective removal of target in the biological multilayered tissues. In practice the process must be done without overheating the healthy tissue by controlling a source heating energy power and surface cooling temperature. One of the objectives of hyperthermia is to raise the temperature of the skin diseased to a therapeutic value, and then thermally destroy the disease. Here, he wants to describe how the practical surgical problem is modeled by a multilayered optimal control problem for some biological composite tissues, consisting of skin, fat, muscle and tumor. Mathematically, we consider bio-heat transfer equation with practical boundary conditions to attain the desired temperature at the specific final time. The microwave, the ultrasound, and the laser are popular power heating apparatus used to deposite heat for treating the tumor in the deep biological body. In this approach, the laser heat source induced by conducting heating probe inserted at the tumors site. We control the tumor temperature inside the composite tissue, by controlling the laser heat source while the heat source is unknown and decomposed in each preassigned time period discretization. Problems are solved using strongly continuous semi-groups theory and Laplace transformation. A solution matches at the adjacent layers interfaces. Strongly continuous semi-groups theory used to compute the optimal control functional at the specific depth inside biological body. Mathematical simulations for a thermal therapy in the presence of internal tumor and external laser heat source are given to investigate the method's efficiency. The proposed efficient method confirms both practical and theoretical approaches.

Speaker Biography

Alaeddin Malek is currently working in private practice as a Tarbiat Modares University Tehran, Iran. He is the author of Over Research Publications, in peer-reviewed journals.

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