

WYDZIAŁ MECHANICZNY TECHNOLOGICZNY
KATEDRA MECHANIKI
I INŻYNIERII OBLICZENIOWEJ

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MODELOWANIE HIPERTERMII ONKOLOGICZNEJ
Z WYKORZYSTANIEM RÓWNAŃ Z DWOMA CZASAMI
OPÓŹNIEŃ

Promotor

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Gliwice, 2023

Modelling of high-temperature hyperthermia using the dual-phase lag equation

Summary

One of the methods supporting cancer treatment is artificial hyperthermia, i.e. local heating of the tumor in order to destroy it. The doctoral thesis concerns the modeling of high-temperature hyperthermia. The mathematical model is based on a dual-phase lag equation, in which the thermophysical parameters of the tissue vary with temperature.

The heating of the biological tissue was carried out by adopting the appropriate boundary condition or by introducing the source function into the dual-phase lag equation. Tissue heating with a laser beam is also considered. In this case, the variability of optical parameters is taken into account using the Arrhenius integral, which is a measure of the degree of tissue destruction. Temperature distributions and the degree of destruction of the tumor tissue were also analyzed, taking into account the presence of a thermally significant blood vessel.

The tasks have been solved using the implicit finite difference scheme. Algorithms and self-written computer programs in C++ (solver) and Python (post-processing) were developed. The results of numerical computations for different variants of heating the analyzed domain are also presented. In the final part of the work the conclusions and also the directions for further research are formulated.