Computer Modelling of RFA Hepatic Tumor Ablation in 3D

K. Georgiev[1], O. Iliev[2], N. Kosturski[1], S. Margenov[1], Y. Vutov[1]
[1] Institute of Information and Communication Technol;ogies, BAS, Sofia, Bulgaria
{georgiev, kosturski, margenov, vutov}@parallel.bas.bg
[2] Fraunhofer ITWM, Kaiserslautern, Germany
oleg.iliev@itwm.fraunhofer.de

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The minimally invasive treatment called radio-frequency ablation (RFA) guided by imaging techniques, the doctor inserts a thin needle through the skin and into the tumor. High-frequency electrical energy delivered through this needle heats and destroys the tumor. The circuit is closed with a ground pad applied to the patient's skin.

This work concerns the mathematical modeling and computer simulations of the heat transfer process. The core is solving the bio-heat time-dependent partial differential equation of parabolic type [1]. Both, a uniform discretization of the considered time interval and an adaptive time-stepping procedure are applied. The last one is due to an effort to decrease the simulation time. Computer simulation on geometry obtained from a magnetic resonance imaging (MRI) scan of the patient is performed.

In this paper we will focus on: (i) the heat transfer accounting the blood circulation in the small blood vessels, and (ii) the heat transfer accounting the blood circulation in the portal vein.

Results of some numerical experiments performed on a selected test problems are presented and discussed. the model.

References

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