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FAST NUMERICAL SIMULATIONS OF THERMAL THERAPY FOR ACOUSTIC ABLATION OF CANCEROUS TUMORS

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ABSTRACT In this paper we describe results of transient temperature calculations of liver ablation using ultrasound therapy. An explicit method is used to integrate the Pennes bio-heat transfer equation on a very refined grid. The energy deposited by the ultrasound applicator is represented by an exponentially decaying source term. The novelty of the present method is the implementation on a Graphics Processing Unit (GPU). The GPU is a data parallel chip, which contains several hundreds to thousands of cores. Each core can be as much as 30% the speed of a modern day CPU, thus significant speed-ups over a CPU can be obtained. For the properties of the tissue, the explicit method is superior to an implicit method as the time step restrictions are not very severe. Explicit methods are also very attractive for data parallel computations. Using the explicit method, calculations are performed for a sample tissue (chicken liver) for which damage patterns have been measured. The computed results are compared with these measurements and satisfactory agreement is seen.