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APPLICATION OF THE BAYESIAN INVERSE METHODS TO ESTIMATE INITIAL CONDITION FOR HEAT TRANSFER PROBLEMS

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The heat transfer equation is of great practical importance, assuming that all unambiguity conditions are given (geometry, initial and boundary conditions, physical properties and sources) problems described by this equation are well-posed in the Hadamard sense. If any of the unambiguity conditions is missing we refer the problem as an inverse or indirect problem, in most cases inverse problems are improperly posed (ill-posed). Specific type of inverse heat conduction problems are problems with missing initial condition information which are called inverse initial problems. The inverse initial problems are of great practical importance because in complicated real-life processes it is not easy to establish or measure initial temperature field or other dependent variable. In practical applications usually it is overcome by assuming any reasonable initial field based on the measurements if they are available or based on the general knowledge on the analysed process. Usually, the unsteady heat transfer equation is of parabolic type, hence for sufficiently long computational times the influence of the initial conditions can be neglected as their influence on the solution decrease with time. This makes the initial inverse problems ill-posed.

Usually, when the initial inverse problem is considered one assumes that the temperature field is known at some final time instance and the task is to reconstruct initial temperature field. In practical applications it seems to be too optimistic to have the complete temperature field at some time instance. In this work we considered two-dimensional initial inverse problem in which initial distribution the dependent variable is reconstructed based on the unsteady measurements taken in a selected sampling points inside a body. In order to overcome ill-posed character of the considered problem the Markov Chain Monte Carlo method
was applied to solve it [1].

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