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ON A CALCULATION METHOD OF STEADY-STATE SOLUTIONS FOR A NONLOCAL HEAT TRANSFER PROBLEM[1]

KĀRLIS BIRĢELIS

Faculty of Physics and Mathematics, University of Latvia
Zeļļu iela 8, Rīga LV-1002, Latvia
Institute of Mathematics and Computer Science
Raiņa bulvāris 29, Rīga LV-1459, Latvia
E-mail: k.birgelis@gmail.com

We consider a nonlinear and nonlocal boundary value problem arising in glass fabric industry to model heating up of glass fabric sheets in special type furnaces (see [3]). To adequately model heat transfer processes at high temperatures, various physical phenomena must be encountered in the model – heat conduction, medium convection, heat radiation propagation. Unfortunately, simultaneous modeling of all these processes leads to hard nonlinear integro-differential boundary value problems. In the previous papers (see [1], [2], for example) we already analyzed the given boundary value problem. As result, various theoretical results were obtained – existence and uniqueness of weak solutions, as well as estimates for lower and upper bounds and continuous dependence on parameters for these solutions. To calculate steady-state solutions for the given problem we used a Newton like iterative method. In order to overcome difficulties with a small convergence domain of the standard Newton method and enforce convergence towards the steady-state solution for any reasonable initial guess, we used pseudo transient continuation as Jacobian regularization techniques. As result, we obtained a calculation algorithm with two good features – high convergence rate and large convergence domain.

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