

SUMMARY OF PHD THESIS

Title: Data Assimilation in Heat Conduction

Speciality: Differential and Integral Equations

Speciality Code: 62 46 01 03

PhD Student: Nguyen Thi Ngoc Oanh.

Supervisor: Prof. Dr. Habil. Dinh Nho Hào.

Training institute: Institute of Mathematics - Vietnam Academy of Science and Technology.

The problems of reconstructing the initial condition in parabolic equations from the observation at the final time, from interior integral observations, and from boundary observations are studied. We reformulate these inverse problems as variational problems of minimizing appropriate misfit functionals. We prove that these functionals are Fréchet differentiable and derive a formula for their gradient via adjoint problems. The direct problems are first discretized in space variables by the finite difference method and the variational problems are correspondingly discretized. The convergence of the solution of the discretized variational problems to the solution of the continuous ones is proved. To solve the problems numerically, we further discretize them in time by the splitting method. It is proved that the completely discretized functionals are Fréchet differentiable and the formulas for their gradient are derived via discrete adjoint problems. The problems are then solved by the conjugate gradient method and the numerical algorithms are tested on computer. As a by-product of the variational method based on Lanczos' algorithm, we suggest a simple method to demonstrate the ill-posedness.

Supervisor

Hanoi, May 08, 2017

PhD Student

Prof. Dr. Habil. Dinh Nho Hào

Nguyen Thi Ngoc Oanh