JOURNAL OF INTEGRAL EQUATIONS
AND APPLICATIONS
Volume 20, Number 2, Summer 2008

IDENTIFICATION OF A TEMPERATURE DEPENDENT HEAT CONDUCTIVITY VIA ADAPTIVE GRID REGULARIZATION

ANDREAS NEUBAUER

Communicated by Charles Groetsch

This paper is dedicated to the 70 th birthday of Zuhair Nashed

ABSTRACT. In this paper we treat the identification of a temperature dependent heat conductivity in an elliptic partial differential equation from a single boundary measurement. We are especially interested in conductivities with discontinuities. Therefore, we apply the recently developed *adaptive grid regularization* method. After showing results about the convergence of the method we present numerical results that demonstrate in a convincing way that this method is a powerful tool to identify discontinuous heat conductivities.

1. Introduction. In this paper we want to deal with the identification of the parameter a in

$$\begin{aligned} -\operatorname{div}(a(u)\nabla u) &= f \quad \text{in } \Omega \\ a(u)\frac{\partial u}{\partial n} &= h \quad \text{on } \Gamma = \partial\Omega \end{aligned} \tag{1.1}$$

from a single measurement of u at the boundary Γ.

Usually, one assumes that a varies spatially on $x \in \Omega$. However, there are interesting problems such as in the cooling process of a steel strand where the heat conductivity depends merely on the temperature. The stationary case leads to the nonlinear elliptic equation above.

Equation (1.1), however with mixed boundary conditions instead of pure Neumann ones, was considered in [6], i.e., a Neumann condition

Received by the editors on March 7, 2007, and in revised form on September 3, 2007.

DOI:10.1216/JIE-2008-20-2-229