Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **10 (2003)** 827-850
Copyright ©2003 Watam Press

IDENTIFICATION OF SPATIALLY DEPENDENT COEFFICIENTS IN PARTIAL DIFFERENTIAL EQUATIONS

P. DuChateau[1] and A. Badran[2]

[1]Department of Mathematics, Colorado State University
Fort Collins, Colorado 80523, USA

[2]Mansura University, New Damiatta, Egypt

Dedicated to John Cannon on the occasion of his 65th birthday.

Abstract. This paper describes a new formulation of an inverse problem for the identification of spatially variable unknown coefficients. This formulation is related to the Backus-Gilbert method and amounts to projecting the unknown coefficient into a finite dimensional subspace whose definition is based on the measured data and other ingredients in the problem. The advantage of the method lies in the fact that the resolution of the identification is not specified a-priori but can be chosen after the main part of the computation is completed. This avoids one of the principle sources of instability in coefficient identifications by output least squares algorithms. The method applies to simultaneous identification of multiple coefficients as well..

Keywords. coefficient identification, inverse problem, Backus-Gilbert method.

AMS (MOS) subject classification: This is optional. But please supply them whenever possible.

1 Introduction

Estimating unknown coefficients in partial differential equations from overspecified data measurements is one of the more active subareas in the general area of inverse problems. In particular, unknown coefficient problems in which the unknown is a function of the independent variables in the problem arise in a variety of applications including electrical prospecting and estimation of hydraulic properties in reservoir simulation, [1]. A typical approach to identifying spatially dependent coefficients is to use the overspecified data to define a functional which measures least squares misfit between the measured data and model output. Application of this output least squares (OLS) approach to inverse problems in groundwater flow in particular is well documented in [1] . One difficulty associated with OLS lies in the fact that it generally requires an a-priori choice of parameterization for the space of coefficients. Choosing a parameterization that is too coarse may make it difficult to reconcile the data, while a parameterization that is too fine can lead to