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Identification of memory kernels in general linear heat flow

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Abstract — Inverse problems for identification of memory kernels in general linear heat flow are reduced to systems of two nonlinear convolution equations of the first kind. These equations in turn are transformed to such ones of the second kind under certain regularity assumptions. In this way global in time existence, uniqueness and stability results for the inverse problems are proved.

1. INTRODUCTION

In the general linear theory of heat conduction in materials with memory the constitutive relations between heat flux and gradient of temperature and between internal energy and temperature involve integral terms over the past history of the material containing time-dependent convolution kernels.These memory kernels are in fact a priori unknown in applications. Inverse problems for determining memory kernels in linear heat flow are considered by Lorenzi and Sinestrari [16, 17], Lorentzi [13] (see also [14, 15]) and by us [10,11] for the memory kernel of heat flux and by Grasselli [7] and Gentili [5] for two memory kernels. In particular, in [7] as additional data the values of a functional over the temperature in the domain and a functional over the heat flux on the boundary of the domain are used.

In this papers existence of a solution of the inverse problems locally (in [10, 11] globally) in time, uniqueness and stability of the solution are proved by means of contraction arguments. In Grasselli and Lorentzi [8] similar results are obtained for a corresponding inverse problem for a nonlinear abstract parabolic integrodifferential equation.

In this paper we extend our investigations in [10] to inverse problems with two kernels dealing with additional data as in [7] and futher with additional data

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