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IDENTIFICATION OF NONLINEAR TERMS IN BOUNDARY VALUE PROBLEMS RELATED TO ORDINARY DIFFERENTIAL EQUATIONS

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Abstract. We prove existence, uniqueness and stability results concerning the identification of two nonlinear terms in an overspecified boundary value problem related to a (nonlinear) second-order differential equation containing a spectral parameter λ.

0. Introduction. Inverse problems for ordinary differential equations turn out to be a wide and important class of inverse problems. Yet, as is well-known, a very large number of results is devoted to the determination of unknown coefficients in linear second-order differential equations containing a spectral parameter λ (see e.g., [1], [3]).

On the contrary, the case of nonlinear second-order differential equations is much less studied. Our paper wants to contribute in this field. It is strictly related to papers [2] and [4] of the present authors. There they were concerned with the problem of determining (i.e., of establishing existence and uniqueness results for) an unknown term appearing in an equation containing a parameter λ by the means of additional information depending on such a parameter.

In the present paper we consider the problem of determining two unknown nonlinear terms appearing in a second-order differential equation depending on a parameter λ by the means of additional information depending on λ.

Explicitly our problem is the following: *determine a triplet of functions* $m(t)$, $f(t)$, $y(x,\lambda)$ *satisfying the differential equation*

$$[m(y(x,\lambda))y'(x,\lambda)]' = \lambda^2 f(y(x,\lambda)), \qquad (x,\lambda) \in [0,1] \times [0,\Lambda] \tag{0.1}$$

and the boundary conditions

$$y(0,\lambda) = 0, \qquad y'(0,\lambda) = \lambda g(\lambda), \quad \lambda \in [0,\Lambda] \tag{0.2}$$

$$y(1,\lambda) = a(\lambda), \quad y'(1,\lambda) = \lambda d(\lambda), \quad \lambda \in [0,\Lambda]. \tag{0.3}$$

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