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9. Ordinary Differential Equations and Dynamical Systems

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A numerical-analytic method for parametrized BVPs

The following non-linear two-point boundary value problem (BVP) containing parameters both in the differential equation and the boundary condition is considered: $\frac{dx}{dt} = f(t, x, \lambda_1),\ Ax(0) + C(\lambda_1)x(\lambda_2) = d(\lambda_1, \lambda_2),\ x_1(0) = x_{10},\ x_2(0) = x_{20}$. Here $f : [0, T] \times D \times [a, b] \to \mathbb{R}^n,\ D \subset \mathbb{R}^n,\ d : [a, b] \times [0, T] \to \mathbb{R}^n,\ \det C(\lambda_1) \neq 0$; $\lambda_1 \in [a, b]$ and $\lambda_2 \in [0, T]$ are unknown scalar parameters. We give a numerical-analytic successive approximation method to establish existence theorems for a solution $(x^*, \lambda_1^*, \lambda_2^*)$ as well as to construct approximations to this solution. A survey of investigations concerning the method under consideration for various types of BVPs can be found in [1, 2].

References: [1] A. M. Samoilenko and N. I. Ronto, Numerical-analytic Methods of Investigating Periodic Solutions, Mir Publishers, Moscow, 1979. [2] A. M. Samoilenko and N. I. Ronto, Numerical-analytic Methods in the Theory of Boundary Value Problems, Naukova Dumka, Kiev, 1992 (in Russian).