Optimal Estimation of Unknown Data of Cauchy Problem for First Order Linear Impulsive Systems of Ordinary Differential Equations from Indirect Noisy Observations of Their Solutions

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Abstract: This paper is concerned with Cauchy problems for first-order systems of impulsive linear ordinary differential equations with unknown right-hand sides, initial conditions, and jumps of solutions at impulse points entering into the statement of these problems which are assumed to be subjected to some quadratic restrictions. From indirect noisy observations of their solutions on a finite system of intervals, optimal, in a certain sense, estimates of images of unknown data under linear continuous operators are obtained. It is shown how to apply the obtained results for finding the guaranteed estimates of unknown coefficients of the nonlinear Gompers equation which is widely used in population dynamics.

Keywords: *optimal estimate; guaranteed estimate; noisy observations; impulsive ordinary differential equations.*

Mathematics Subject Classification (2010): 34A30, 34A37, 34A55.

1   Introduction

In this paper, for Cauchy problems for systems of linear impulsive ordinary differential equations, we propose a novel technique of finding optimal estimates of images of their data under linear continuous operators. We assume that the right-hand sides of equations, initial conditions, and jumps of solutions at impulse points entering into the statement of these problems are unknown and belong to certain ellipsoids in the corresponding function spaces.

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