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OPTIMAL CONTROL IN ITO-VOLTERRA SYSTEMS

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Abstract. This paper presents solutions of the optimal linear-quadratic control problems for stochastic integral Ito-Volterra systems with continuous/discontinuous states. The obtained solutions are based on applying the duality principle for Volterra systems to the known solutions of the dual filtering problems for Ito-Volterra states over continuous/ discontinuous observations. The optimal control laws and the gain matrix equations are first derived in the general case an Ito-Volterra state equation and then simplified in the case of a dynamic plant governed by a differential state equation. The technical example illustrating application of the obtained results is finally given.
AMS subject classification: 49K22, 93E20

1 Introduction

The optimal control and filtering problems for dynamic systems with delays, which represent a particular case of discontinuous integral systems, have been studied in a number of publications from various viewpoints (see, for example, [9], [10], [1] for dynamic systems and [17] for a particular case of integral Volterra ones). This attention is directly related to common use of dynamic systems with delays in global economy concepts [12], marketing models [13], technical systems [7], and others. Since the class of integral Volterra systems includes the class of retarded dynamic ones, the study of integral systems becomes a significant part of the control theory. Nevertheless, the integral Volterra systems have been of independent interest in the deterministic environment, as well as in the stochastic one (see [2]).

This paper presents solutions of the optimal linear-quadratic control problems for stochastic integral Ito-Volterra systems with continuous and then discontinuous states. There are a number of papers investigating the control problems for continuous system states given by stochastic differential equations (see [11, 19] and bibliography therein) or bivariate Volterra ones [17], or deterministic continuous and discontinuous system states governed by Volterra equations [3, 4]. However, the problems have not been treated yet in the case of integral stochastic systems governed by Ito-Volterra equations. The solution presented in the paper is based on applying the duality principle for Volterra systems (substantiated in [3]) to the known solutions of