Twenty First International Conference on
Geometry, Integrability and Quantization
June 3–8, 2019, Varna, Bulgaria
Ivaïlo M. Mladenov, Vladimir Pulov
and Akira Yoshioka Editors
Avangard Prima, Sofia 2020, pp 291–301
doi: 10.7546/giq-21-2020-291-301

OPTIMAL CONTROL FOR DISCRETE-TIME, LINEAR FRACTIONAL-ORDER SYSTEMS WITH MARKOVIAN JUMPS

VIORICA MARIELA UNGUREANU

Department of Energy, Environment and Agroturism
Constantin Brancusi University of Targu-Jiu, 210135 Targu-Jiu, Romania

Abstract. This paper considers a finite-horizon linear quadratic (LQ) optimal control problem for a class of stochastic discrete-time, linear systems of fractional order which are generated by the operator involved in the definition of the fractional-order derivative of Grünwald-Letnikov type. This subject is new for discrete-time, linear, fractional-order systems (DTLFSs) with infinite Markovian jumps. We use an equivalent linear *expanded-state* model of the DTLFS with jumps and an equivalent quadratic cost functional to reduce the original optimal control problem to a similar one for discrete-time, linear, integer-order systems with Markovian jumps. The obtained optimal control problem is then solved by applying a dynamic programming technique.

MSC: 93CXX, 93C55
Keywords: Dynamic programming, fractional discrete-time systems, linear quadratic control, multiplicative noise

1. Introduction

Fractional calculus (FC) is a branch of mathematics that studies fractional-order derivatives and fractional-order integrals. The idea of defining a fractional order derivative seems to have belonged to Leibniz and l'Hôspital who discussed this subject in a letter, dated 30^{th} September 1695. Since then, a great variety of notions of fractional-order derivatives and integrals have been introduced, but the most popular and accepted definitions are the ones proposed by Riemann-Liouville, Caputo and Grünwald-Letnikov. Some historical surveys of FC and basic information about the current state of the art can be found in [5], [6] and in the references therein. In the past centuries, FC has not attracted the interest of a large scientific