

RISK-SENSITIVE TRACKING CONTROL OF STOCHASTIC SYSTEMS WITH PREVIEW ACTION

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ABSTRACT. *This paper investigates a problem of tracking control for discrete-time stochastic linear systems via the risk-sensitive stochastic optimal control theory with preview action. The risk-sensitive preview tracking controller is designed for an augmented system consisting of a tracking error system, an incremental state system and a command generator which makes future information of the reference signal for the preview action. In the simulation studies, it has been shown that the derived controller has successfully achieved to a reduction of the tracking error and increasing the robustness against strong random disturbance.*

Keywords: Stochastic systems, Risk-sensitive control, Tracking control, Preview action, Optimal control

1. **Introduction.** Mechanical and physical systems used in engineering and industry fields require to be controlled so that their output tracks a reference signal. Especially, servomotors used for various mechanical systems are significant technology in industry. The objective of such controllers is to minimize the tracking error and to meet other physical specifications of controlled objects.

It is well known that the tracking control with preview action reduces its tracking error. There are many researches of preview tracking control problems. LQ based preview tracking controls have been investigated by Tomizuka [1,2], Katayama et al. [3], Kojima et al. [4] and Fujisaki et al. [5]. H^∞ control with preview action has been studied by Cohen and Shaked [6], Takaba [7] and Mianzo, Peng [8] to introduce robustness. A preview tracking control for a stochastic system has been considered by Rho and Park [9]. Collings et al. investigated tracking control problems using risk-sensitive control [10]. However the risk-sensitive tracking control with preview action has not been studied.

Jacobson has started the studies on the optimal control problem for discrete-time linear stochastic systems with exponential criteria [11]. Speyer et al. [12] and Bensoussan Speyer et al. [13,14] have extended the Jacobson's control theory to the partial observed systems. Whittle has found the relation between the H^∞ controls and the risk-sensitive control theories [15]. After that, several researchers investigated the risk-sensitive control for nonlinear stochastic systems [16] and satellite systems [17-19].

In this paper a problem of preview tracking control for discrete-time linear stochastic systems via the risk-sensitive stochastic optimal control theory is investigated. The risk-sensitive preview tracking controller is designed for an augmented system consisting of a tracking error system, an incremental state systems and a command generator for making preview information of the reference signal. Finally, several numerical results are provided.