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STOCHASTIC OPTIMAL TRACKING WITH PREVIEW BY STATE FEEDBACK FOR LINEAR DISCRETE-TIME MARKOVIAN JUMP SYSTEMS

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Abstract. *In this paper, we study the stochastic optimal tracking problems with preview for a class of linear discrete-time Markovian jump systems. The systems are described by the discrete-time switching systems with Markovian mode transitions. The necessary and sufficient conditions for the solvability of the optimal tracking problems are given by coupled Riccati difference equations with terminal conditions. Correspondingly, feedforward compensators introducing future information are given by coupled difference equations with terminal conditions. We consider three different tracking problems depending on the property of the reference signals. Finally we give numerical examples.*
Keywords: Markovian jump systems, Stochastic linear quadratic (LQ) optimization, Tracking control with preview, Coupled Riccati equations, Coupled feedforward compensators

1. **Introduction.** It is well known that, for design of tracking control systems, preview information of reference signals is very useful for improving performance of the systems, and recently much work has been done for preview control systems [3, 9, 8, 12, 13, 14, 15, 16, 17, 19, 20, 25]. Especially, in order to design tracking control systems for a class of systems with rapid or abrupt changes, it is effective in improving tracking performance to construct tracking control systems considering future information of reference signals.

U. Shaked et al. have constructed the H_∞ tracking control theory with preview for continuous- and discrete-time linear time-varying systems by a game theoretic approach [3, 20]. Recently, the author has extended their theory to linear impulsive systems [14, 15]. It is also very important to consider effects of stochastic noise or uncertainties for tracking control systems, and so, by Gershon et al., the theory of stochastic H_∞ tracking with preview has been presented for linear continuous- and discrete-time systems respectively [8, 9]. The H_∞ tracking theory by game theoretic approach can be restricted to optimal or stochastic optimal tracking theory and also extended to stochastic H_∞ tracking control theory [8, 9, 10]. While some command generators of reference signals are needed in the papers [19, 25], a priori knowledge of any dynamic models for reference signals is not assumed on the game theoretic approach. All these works have been studied for the systems with no mode transitions.

Markovian jump systems [2, 4, 5, 6, 7, 11, 21, 22, 23, 24] have abrupt random mode changes in the dynamics. The mode changes follow Markov processes. Such systems may be found in the area of power systems, manufacturing systems, communications, aerospace systems, financial engineering and so on. Such systems are classified into continuous-time [2, 11, 21, 22, 23, 24] and discrete-time [4, 5, 6, 7] systems. The optimal and H_∞ control theory has been presented for each of these systems respectively [4, 6, 7, 21, 23, 24]. The stochastic LQ and H_∞ control theory for Markovian jump systems are of high practice.