Jump Linear Systems in Automatic Control*

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A description of the book’s content by chapter follows. In Chapter 1 the model for which one may expect to derive approximations is a specific model. The book restricts attention to a specific model. The parameters of the control system are assumed to vary over a finite set. The control process is called the regime. The model is realistic only if the time constants of the Markov chain are an order of magnitude larger than those of the control system. The regime process is chosen by nature. The optimum result is called an equalizing solution.

Chapter 5. The jump quadratic Gaussian regular problem is considered. The continuous-time stochastic control system is described by a stochastic differential equation.


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The topic of this book is control of uncertain systems. The model is rather specific, it consists of a deterministic or stochastic control system of which the parameters vary over a finite set according to a finite-state Markov process. The hybrid system is an elementary model for which one may expect to derive structural properties of control laws. The author credits Krasovskii, Lidskii, and Florentin with proposing this model around 1961. The author has been inspired by the publications of Sworder on the subject.

The background required for a study of the book includes system identification, stochastic control of Gaussian systems, and elementary probability and stochastic processes. The level at which these topics should be known is last year undergraduate or first year graduate. The book is quite suitable for self study.

Before presenting a summary of the book’s content, it seems appropriate to introduce the model and to motivate its use for control. Consider a control process and a mathematical model of it in the form of a deterministic or stochastic control system. Such a model is in general only an approximation of the control process. Moreover, the dynamics of the control process may change in time. The main control objectives are that the controlled system is stable, has satisfactorily transient response, and does not use too much input energy. The regime process is chosen by nature. The optimum result is called an equalizing solution. For this a successive approximation algorithm and a homotopy algorithm are described and illustrated with examples.

In Chapter 4, titled “Robustness”, actually concentrates attention on the sensitivity of performance measures for changes in the model and in the control law. The robustness is obtained for a constant regime, hence the optimal control law has long obscured the risk-aspect of control of stochastic systems. Only the recent interest in the exponential cost criteria has rekindled interest in the risk-sensitivity of stochastic control problems. In this chapter attention is focused on the variance of the integral cost, on the probability that the integral cost exceeds a specified bound, and in a special case on the distribution of the cost. The effect of different feedback laws on these performance measures is evaluated. Next a minimax solution is derived in which the upperbound on the variance of the integral cost is minimized. Another viewpoint is that in which the regime process is chosen by nature. The optimal control problem reduces to a deterministic control problem. This result is called an equalizing solution. In Chapter 5 the jump quadratic Gaussian regular problem is considered. The continuous-time stochastic control system is described by a stochastic differential equation.
Abstract—This paper addresses the dynamic output feedback control problem of continuous-time Markovian jump linear systems. The fundamental point in the analysis is an LMI characterization, comprising all dynamical compensators that stabilize the closed-loop system in the mean and $\ell_2$-norm control problems are studied, and square sense. The the and filtering problems are solved as a by produc