論文 / 著書情報
Article / Book Information

題目(和文)	
Title(English)	Sampled-Parameter Feedback Control for Dynamical Systems with Stochastic Parameters
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出典(和文)	学位:博士(学術), 学位授与機関:東京工業大学, 報告番号:甲第9580号, 授与年月日:2014年3月26日, 学位の種別:課程博士, 審査員:早川　朋久,木村　康治,井村　順一,山北　昌毅,石井　秀明
Citation(English)	Degree:Doctor (Academic), Conferring organization: Tokyo Institute of Technology, Report number:甲第9580号, Conferred date:2014/3/26, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	審査の要旨
Type(English)	Exam Summary

（博士課程）

論文審査の要旨及び審査員

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論文審査の要旨（2000 字程度）

This dissertation is entitled “Sampled-Parameter Feedback Control for Dynamical Systems with Stochastic Parameters” and composed of 11 chapters, wherein a feedback control framework is developed for the stabilization of stochastic systems where the system parameters of the plant are randomly varying. The feedback controllers are allowed to sample the system parameters in a periodic or randomized manner.

In Chapter 1 (Introduction), the existing formulation of stochastic systems is overviewed and the significance and validity of assuming that the controllers can sample the system parameters are described. Consequently, it is stated that the purpose of the thesis is to derive feedback controllers under a variety of conditions and to provide analysis for closed-loop stability in each chapter.

In Chapter 2 (Mathematical Preliminaries), several definitions and some key results concerning continuous-time and discrete-time stochastic processes are introduced.

In Chapter 3 (Feedback Control of Continuous-Time Switched Linear Stochastic Systems Using Uniformly Sampled Mode Information), the mode signal is modeled as a continuous-time Markov chain. The feedback control law turns out to depend only on the uniformly (periodically) sampled mode information rather than the actual mode signal.

In Chapter 4 (Stabilization of Switched Linear Stochastic Systems Under Delayed Discrete Mode Observations), stability of the closed-loop switched stochastic system with a piecewise-constant feedback gain is analyzed. As a consequence, the feedback gain can be constructed with the information of the delayed and the sampled version of the mode signal.

In Chapter 5 (Probability-Based Feedback Gain Scheduling for Stabilizing Switched Linear Stochastic Systems Under Delayed Sampled Mode Information), a control framework is proposed in which the controller relies on a probability-based feedback gain scheduling scheme that utilizes the available delayed sampled mode data as well as *a priori* information concerning the stochastic dynamics of the mode signal.

In Chapter 6 (Sampled-Mode-Dependent Time-Varying Control Strategy for Stabilizing Discrete-Time Switched Stochastic Systems), second-moment asymptotic stabilization is investigated. It is stated that the key idea is to employ discrete-time Floquet theory to obtain necessary and sufficient conditions when the parameters are only periodically sampled.

In Chapter 7 (Stabilizing Discrete-Time Switched Linear Stochastic Systems Using Periodically Available Imprecise Mode Information), a feedback control law is derived for the case where the modes of the switched system are divided into a number of groups. It is shown that the controller requires only the mode group information that is assumed to be available.

In Chapter 8 (Sampled-Mode Stabilization of Switched Linear Stochastic Dynamical Systems With Exponentially Distributed Random Mode Sampling Intervals), the bivariate process composed of the actual mode signal and its sampled version is constructed and shown to be a finite-state continuous-time Markov chain. As a consequence, sufficient conditions for almost sure asymptotic stabilization are characterized.

In Chapter 9 (Feedback Control of Discrete-Time Switched Stochastic Systems Using Randomly Available Active Mode Information), it is assumed that the active operation mode is observed only at random time instants. Specifically, the stochastic dynamics of a sequence-valued stochastic process are characterized that capture some key properties of the evolution of the active mode between mode observation instants.

In Chapter 10 (Sampled-Parameter Feedback Control of Discrete-time Linear Stochastic Parameter-Varying Systems), the parameter of the system is modeled as a discrete-time stationary and ergodic Markov process and a special class of linear parameter-varying systems is explored where the state matrix is an affine function of the entries of the parameter vector. It is shown that stabilization for this class of parameter-varying systems can be achieved through a control law with a feedback gain that is an affine function of the entries of the sampled parameter vector.

Finally, in Chapter 11 (Conclusion), concluding remarks for this dissertation are drawn and future extensions are discussed.

In summary, this dissertation develops a feedback control framework for stochastically parameter-varying systems with limited available information on the system parameters. The contribution of this dissertation in the field of control theory is scientifically significant in that the dissertation generalizes the existing problem formulation of switched stochastic systems and provides a synthetic framework for guaranteeing closed-loop stability. Consequently, it is concluded that this dissertation is of sufficient merit as a doctoral thesis, deserving the degree of doctor of philosophy.