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Aims and Scope

Optimization has been expanding in all directions at an astonishing rate during the last few decades. New algorithmic and theoretical techniques have been developed, the diffusion into other disciplines has proceeded at a rapid pace, and our knowledge of all aspects of the field has grown even more profound. At the same time, one of the most striking trends in optimization is the constantly increasing emphasis on the interdisciplinary nature of the field. Optimization has been a basic tool in all areas of applied mathematics, engineering, medicine, economics, and other sciences.

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Resilient Controls for Ordering Uncertain Prospects

Change and Response

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*This monograph is dedicated to
increased awareness and understanding
through stochastic dominance
as exemplified by the growth
of performance-measure statistics
in statistical optimal control theory
during the past decade*

*and to Huong Nguyen, An and Duc,
my wife and children
who have encouraged much in this ideal*

Preface

Thoroughly engaged in systematically exploring mathematical statistics which are conducive to feedback and stability analysis associated with stochastic regulators and performance uncertainty, I was an unlikely candidate for the task of chronicling and analyzing resilient controls from theoretical, algorithmic, and application perspectives described here. Such a project was far from my mind when this emerging field of resilient control research with far-reaching impact on a variety of applications has suddenly drawn my attention.

But as with any domain, resilient controls require the environments to be sensed in order to be able to have situational awareness. Performance uncertainty sensing seeks to exploit any part of the uncertainty spectrum in order to provide uncertain prospects necessary for that situational awareness so the integrity of performance assessment and the controlled systems that bind them can be better maintained and managed. Needless to say, *Resilient Controls for Ordering Uncertain Prospects* was written under the influence of this indignation and it suffers, no doubt, from the shortcomings of any work by subject matter experts.

The primary aim of this monograph is to give an account of resilient controls in risk-averse decision making for elective studies, research references, and graduate-level lectures in applied mathematics and electrical engineering with systems-theoretic concentration. Some of my arguments and supports for timely and responsive reforms on the use of asymmetry or skewness pertaining to the restrictive family of quadratic costs have appeared in various scholarly forums. Such theoretical constructs and design principles, especially when they underline the complexity of the resilient controls with risk-averse attitudes, are expected to have broad appeal.

Not to acknowledge the following would be an omission that detracts not only from their contribution to and ownership of parts of the monograph but also from its worth. I have also accumulated debts to individuals. It is no exaggeration to say that this particular monograph would not have been written without the encouragement

and assistance of my wife, Huong, and my children, An and Duc, on the domestic front where I was allowed to use my spare time for writing this monograph.

Of course, Professors Stanley R. Liberty and Michael K. Sain were a part of this effort, as they were the research advisors with whom I had the pleasure of collaboration during the graduate studies at University of Nebraska and University of Notre Dame. They have some idea, I expect, of how grateful I am to them. In case of doubt, they should refer to this monograph's frontispiece.

Let me close the preliminaries of this monograph and claim sole responsibility for the work. *Resilient Controls for Ordering Uncertain Prospects* was written in anxious haste, and no one bears much responsibility for its final form. Certainly, no one with whom I am associated should be held accountable for the ideas or analyses expressed here.

Albuquerque, USA
January, 2014

Khanh D. Pham

Contents

1	Introduction	1
1.1	Emerging Research, New Challenges	1
1.2	Monograph Ideas and Contributions	2
1.3	Methodology	3
1.4	Chapter Organization	3
	References.....	6
2	Actuator Failure Accommodation in Risk-Averse Feedback Control	7
2.1	Introduction.....	7
2.2	Patterns of Performance Uncertainties	8
2.3	Moving Toward Problem Statements	16
2.4	Conceptualizing Risk-Averse Control Strategy	21
2.5	Chapter Summary	26
	References.....	26
3	Towards a Risk Sensitivity and Game-Theoretic Approach of Stochastic Fault-Tolerant Systems	27
3.1	Introduction.....	27
3.2	Revisiting Performance Statistics for Resiliency	28
3.3	Framing the Problem Statements	35
3.4	Saddle-Point Strategies with Risk Aversion	41
3.5	Chapter Summary	47
	References.....	47
4	Disturbance Attenuation Problems with Delayed Feedback Measurements	49
4.1	Introduction.....	49
4.2	A Digression on the Problem, States and Observables	50
4.3	Problem Statements of Lower and Upper Values	63
4.4	Saddle-Point Strategies with Risk Aversion	69

4.5	Chapter Summary	79
	References	79
5	Performance Risk Management in Weakly Coupled Bilinear Stochastic Systems	81
5.1	Introduction.....	81
5.2	Meeting the Problem	82
5.3	Responses to Performance Uncertainties.....	85
5.4	Statements of Mayer Problem with Performance Risk	89
5.5	Risk-Averse Control as Adaptive Behavior	94
5.6	Chapter Summary	98
	References.....	99
6	Risk-Averse Control of Weakly Coupled Bilinear Stochastic Systems	101
6.1	Introduction.....	101
6.2	Assessing Performance Statistics for Robustness.....	102
6.3	Depicting the Problem Statements	114
6.4	Low Sensitivity Control with Risk Aversion.....	118
6.5	Chapter Summary	122
	References.....	123
7	Resilient Control of A Class of Uncertain Time-Delay Systems	125
7.1	Introduction.....	125
7.2	Toward Performance Resiliency	126
7.3	Participation in the System Control Problem	136
7.4	Framing Resilient Control Solutions	143
7.5	Chapter Summary	147
	References.....	148
8	Networked Control with Time Delay Measurements and Communications Channel Constraints	149
8.1	Introduction.....	149
8.2	Pursuing Performance Robustness	150
8.3	Asserting Problem Statements.....	163
8.4	The Quest for Risk-Averse Control Solutions	170
8.5	Chapter Summary	175
	References.....	175
9	Risk-Averse Control of Networked Systems with Compensation of Measurement Delays and Control Rate Constraints	177
9.1	Introduction.....	177
9.2	Relevance of Performance Statistics for Stochastic Dominance ...	178
9.3	Toward the Optimal Decision Problem.....	191
9.4	Persisting Statistical Optimal Control in Resiliency.....	198

- 9.5 Chapter Summary 202
- References 203
- 10 Epilogue** 205
 - 10.1 Concern over Greater Uncertainty Quantification 205
 - 10.2 Breakthrough for Resilient Controls 206
 - 10.3 The Door Opens 206
- Index** 209

List of Figures

Fig. 2.1	Structure of stochastic fault-tolerant control with non-cognitive actuator failures	8
Fig. 2.2	Risk-averse feedback system with statistical measures of risks	24
Fig. 3.1	Structure of resilient controlled systems with actuator tampers	29
Fig. 3.2	Engagement structure between resilient controller and persistent actuator tamper.....	45
Fig. 4.1	Arrangement of disturbance attenuation studied	51
Fig. 4.2	Pade approximation to a pure time delay	51
Fig. 4.3	Structure of stochastic disturbance attenuation system with Pade approximation for delayed feedback measurements	53
Fig. 4.4	Realization of Kalman-like estimator	53
Fig. 4.5	Disturbance attenuation system with delayed feedback measurements integrated with resilient control towards cognitive disturbances	73
Fig. 5.1	A description of stochastic bilinear controlled systems	82
Fig. 5.2	Bilinear stochastic system with risk-averse control integration block diagram.....	97
Fig. 6.1	Structure of bilinear stochastic system with some noisy observations	104
Fig. 6.2	Block diagram of Kalman-like observer for the current system states.....	106
Fig. 6.3	Observer diagram for trajectory sensitivity variables	107
Fig. 6.4	Block diagram interpretation of estimate errors of the trajectory sensitivity variables	108
Fig. 6.5	Block diagram of estimate errors of the system states	108

Fig. 6.6	Structure of risk-averse controlled bilinear system with noisy output observations	122
Fig. 7.1	Stochastic linear systems with uncertainty, state and input time delays, and risk aversion	127
Fig. 7.2	Structure pertinent to aggregation of the approximate system model	129
Fig. 7.3	State-space realization of the state estimator	130
Fig. 7.4	Implementation of risk-averse control for uncertain time-delay stochastic systems	146
Fig. 8.1	Structure of stochastic control	150
Fig. 8.2	Pade approximation structure for delayed observations	152
Fig. 8.3	Realization of bandlimited communications channel	152
Fig. 8.4	Implementation by controlled system, Pade approximation, and bandlimited channel	153
Fig. 8.5	Structure illustrating the system state estimation	154
Fig. 8.6	Implementation by the resilient controlled system	174
Fig. 9.1	Structure of stochastic controlled system with delayed observations	179
Fig. 9.2	Block diagram of the controlled system with control rates and delayed observations	180
Fig. 9.3	Implementation diagram illustrating Brown motions of white noises	181
Fig. 9.4	Model of state estimation	182
Fig. 9.5	Implementation by least mean-square predictor	183
Fig. 9.6	Structure of resilient controlled systems	201