Contents

1	Y. E	Ermoliev, N	M. Makowski, and K. Marti		
	Ref	erences		7	
Par	t I	Modeling	of Uncertainty and Probabilistic Issues		
2	On	Joint Mod	delling of Random Uncertainty		
		•	precision	11	
	Olgierd Hryniewicz				
	2.1		action	11	
	2.2		alizations of Classical Probability		
			eir Applications in Decision Making	13	
		2.2.1	Measures of Uncertainty and Criteria		
			of Their Evaluation	13	
		2.2.2	Probability	15	
		2.2.3	Dempster-Shafer Theory of Evidence		
			and Possibility Theory	17	
		2.2.4	Imprecise Probabilities and Their Generalizations	20	
	2.3	Fuzzy I	Random Variables and Fuzzy Statistics	22	
	2.4		ations of Fuzzy Statistics in Systems Analysis		
		2.4.1	Example 1: Verification of the Kyoto Protocol		
		2.4.2	Example 2: Sequential Testing		
			of a Hypothesis About the Mean Value		
			in the Normal Distribution	31	
	2.5	Conclu	isions	33	
	Ref	erences		35	
3	Ω	the Amun	oximation of a Discrete Multivariate		
3					
	Probability Distribution Using the New Concept				
	of t-Cherry Junction Tree 39				
	Edith Kovács and Tamás Szántai				
	3.1		action		
	3.2		inaries		
		3.2.1	Notations	4(



x Contents

		3.2.2	Cherry Tree and t-Cherry Tree	41			
		3.2.3	Junction Tree				
	3.3	t-Cheri	ry-Junction Tree	43			
		3.3.1	Construction of a t-Cherry-Junction Tree	43			
		3.3.2	The Approximation of the Joint Distribution				
			Over X by the Distribution Associated				
			to a t-Cherry-Junction Tree	44			
		3.3.3	The Relation Between the Approximations				
			Associated to the First-Order Dependence				
			Tree and t-Cherry-Junction Tree	47			
	3.4	Some F	Practical Results of Our Approximation and Discussion	ns 50			
	Refe	rences	***************************************	56			
Par	rt II	Robust So	olutions Under Uncertainty				
4			ounting and Risk Management	59			
			Y. Ermoliev, G. Fischer, and M. Makowski				
	4.1		ction				
	4.2		rd and Stopping Time Induced Discounting				
	4.3		eclining Discount Rates				
	4.4		enous Discounting				
	4.5		ic Risk Profiles and CVaR Risk Measure				
	4.6		nporal Inconsistency				
	4.7	Conclu	ding Remarks	75			
	Refer	ences		76			
5			and Environmentally Safe Emission				
			r Uncertainty	79			
		T. Ermolieva, Y. Ermoliev, G. Fischer, M. Jonas,					
		1. Makow					
	5.1		ction				
	5.2		ninties and Trends of Carbon Fluxes				
	5.3		bility of Emission Changes				
	5.4		equilibrium Under Uncertainty				
	5.5		ic Bilateral Trading Processes				
	5.6		terized Multi-agent Decentralized Trading System				
	5.7		Market Processes				
	5.8	Conclu	ding Remarks				
	Refer	ences		97			
6	Robu	st Design	of Networks Under Risks	101			
		Y. Ermoliev, A. Gaivoronski, and M. Makowski					
	6.1		ction	101			
	6.2	Coopera	ative Provision of Advanced Mobile Data Services	104			
	6.3		ied Model of the Service Portfolio				
		6.3.1	Description of Services	106			

Contents

		6.3.2	Profit Model of an Actor	108
		6.3.3	Service Portfolio: Financial Perspective	110
	6.4	Model	ing of Collaborative Service Provision	
		6.4.1	Service Provision Capacities	
		6.4.2	Risk/Return Industrial Expectations	115
		6.4.3	Pricing	116
		6.4.4	Revenue Sharing Schemes	
	6.5	Proper	ties of the Models and Implementation Issues	118
	6.6	Case S	Study	119
	6.7	Dynan	nics of Attitudes	122
		6.7.1	Simplified Model: Direct	
			and Indirect Interdependencies	
		6.7.2	Model Formulation	125
		6.7.3	Bayesian Networks and Markov Fields	
		6.7.4	Sensitivity Analysis	
		6.7.5	General Interdependencies	133
	6.8		usion	
	Refere	ences		136
7	An O	verview	psoidal Estimates of Uncertain Systems: and New Results	141
	F.L. C	hernous	uction	141
	7.1		able Sets	
	7.3		oidal Bounds	
	7.3 7.4		ality	
	7.5		ons of Ellipsoids	
	7.6		ormation of the Equations	
	7.0 7.7		ties of Optimal Ellipsoids	
	7.8	•	alizations	
	7.9		cations	
	7.7	7.9.1	Two-Sided Estimates in Optimal Control	
		7.9.2	Two-Sided Bounds on Time	
			for the Time-Optimal Problem	155
		7.9.3	Suboptimal Control	
		7.9.4	Differential Games	
		7.9.5	Control of Uncertain Systems	
		7.9.6	Other Applications	157
		7.9.6 7.9.7	Other Applications	157 158
	7.10	7.9.7	Other Applications	158
	7.10 7.11	7.9.7 Ellipso	State Estimation in the Presence of Observation Errors.	158 159

xii Contents

8		Expected Total Cost Minimum Design of Plane Frames				
	by Means of Stochastic Linear Programming Methods					
	Kurt	Marti				
	8.1	Introd	uction	164		
		8.1.1	Plastic Analysis of Structures	164		
		8.1.2	Limit (Collapse) Load Analysis of Structures			
			as a Linear Programming Problem	165		
		8.1.3	Plastic and Elastic Design of Structures	167		
	8.2	Plane 1	Frames			
		8.2.1	Yield Condition in Case of $M - N$ -Interaction	173		
		8.2.2	Approximation of the Yield Condition			
			by Using Reference Capacities			
	8.3	Stocha	astic Optimization	183		
		8.3.1	Violation of the Yield Condition	184		
		8.3.2	Cost Function			
		8.3.3	Choice of the Cost Factors	186		
		8.3.4	Total Costs	187		
		8.3.5	Discretization Methods	189		
		8.3.6	Complete Recourse	190		
	Refe	rences	***************************************	191		
9			in the Future Nitrogen Load to the Baltic Sea			
	Due to Uncertain Meteorological Conditions195					
	Jerzy Bartnicki					
	9.1	Introdu	uction	195		
	9.2	Nitrog	en Emissions	198		
		9.2.1	National Emission Ceilings According			
			to EU NEC Directive	198		
		9.2.2	National Emission Ceilings According			
			to Gothenburg Protocol	199		
		9.2.3	Nitrogen Emission Projections Used			
			in the Model Runs	200		
	9.3	Compu	uted Nitrogen Depositions for 2010	201		
		9.3.1	Unified EMEP Model	202		
		9.3.2	Calculated Depositions to Sub-basins			
			and Catchments of the Baltic Sea			
	9.4		tainty Due to Meteorological Variability			
	9.5		usions			
	Refer	References				

Contents xiii

10	Planning Sustainable Agricultural Development Under					
			209			
	G. Fischer, T. Ermol		200			
		and Co-existence for Risk Sharing				
		Planning Under Risks				
		imulation Model				
		implified Production Model				
		ebalancing Production-Allocation Algorithm				
		roduction Allocation Model				
		xperiments				
	10.6 Conclusions		225			
	References		226			
11	Dealing with Uncer	rtainty in GHG Inventories:				
	How to Go About I	t?	229			
	Matthias Jonas, Tho	omas White, Gregg Marland,				
	Daniel Lieberman, Z	Daniel Lieberman, Zbigniew Nahorski, and Sten Nilsson				
	11.1 Introduction		230			
		ainty Matter?				
	11.3 State of the A	Art of Analyzing Uncertain Emission Changes	233			
		with Uncertainty?				
		• • • • • • • • • • • • • • • • • • •				
12	Uncertainty Analysis of Weather Controlled Systems					
	K.J. Keesman and T.					
			247			
		S				
		k Storage Model				
		other Forecasts				
		t Function				
		eding Horizon Optimal Control				
		ecast Uncertainty and Error Analysis				
		n Loop Evaluation				
		sed Loop Evaluation				
	_	Remarks				
	References					
13		Error in Carbon Dioxide Column				
			259			
	Mitsuhiro Tomosada Hiroe Tsubaki, and	a, Koji Kanefuji, Yukio Matsumoto,				
	13.1 Introduction	•	250			

xiv Contents

13.2	Trace C	Gas Measurement by Satellite Remote Sensing	261
	13.2.1	Observations of Trace Gases with Various Sensors	261
	13.2.2	GOSAT Mission	262
	13.2.3	Previous Error Analysis	264
13.3	Error Evaluation and Results		266
	13.3.1	Retrieval Method	266
	13.3.2	Error Evaluation	268
	13.3.3	Error Evaluation Results	270
13.4	Conclu	sions	276
Refere	ences		276