

# Contents

<i>Preface: The Interplay Between Information and Complexity</i>	ix
<b>Part I. Classical Information and Complexity</b>	<b>1</b>
Chapter 1. The “Paradox” of Computability and a Recursive Relative Version of the Busy Beaver Function <i>Felipe S. Abrahão</i>	3
Chapter 2. Inductive Complexity and Shannon Entropy <i>Mark Burgin</i>	16
Chapter 3. Blum’s and Burgin’s Axioms, Complexity, and Randomness <i>Cezar Câmpeanu</i>	33
Chapter 4. Planckian Information ( $I_P$ ): A Measure of the Order in Complex Systems <i>Sungchul Ji</i>	53
Chapter 5. Algorithmically Random Universal Algebras <i>Bakhadyr Khousainov</i>	98

Chapter 6.	Structural and Quantitative Characteristics of Complexity in Terms of Information	117
	<i>Marcin J. Schroeder</i>	
Chapter 7.	Multiscale Information Theory for Complex Systems: Theory and Applications	176
	<i>Blake C. Stacey, Benjamin Allen and Yaneer Bar-Yam</i>	
Chapter 8.	Bounds on the Kolmogorov Complexity Function for Infinite Words	200
	<i>Ludwig Staiger</i>	
<b>Part II.</b>	<b>Quantum Information and Complexity</b>	<b>225</b>
Chapter 9.	Quantum Computational Complexity in Curved Spacetime	227
	<i>Marco Lanzagorta and Jeffrey Uhlmann</i>	
Chapter 10.	A Silk Road from Leibniz to Quantum Information	249
	<i>Rossella Lupacchini</i>	
Chapter 11.	Generalized Event Structures and Probabilities	276
	<i>Karl Svozil</i>	
<b>Part III.</b>	<b>Applications</b>	<b>301</b>
Chapter 12.	An Upper Bound on the Asymptotic Complexity of Global Optimization of Smooth Univariate Functions	303
	<i>James M. Calvin</i>	

Chapter 13. Cellular Automata and Grossone Computations	316
<i>Louis D'Alotto and Yaroslav D. Sergeyev</i>	
Chapter 14. Cognition and Complexity	338
<i>Yuri I. Manin</i>	
Chapter 15. Informational Perspective on QBism and the Origins of Life	353
<i>Koichiro Matsuno</i>	
<i>Index</i>	381