# Emergence, Complexity and Computation

Volume 14

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The Emergence, Complexity and Computation (ECC) series publishes new developments, advancements and selected topics in the fields of complexity, computation and emergence. The series focuses on all aspects of reality-based computation approaches from an interdisciplinary point of view especially from applied sciences, biology, physics, or Chemistry. It presents new ideas and interdisciplinary insight on the mutual intersection of subareas of computation, complexity and emergence and its impact and limits to any computing based on physical limits (thermodynamic and quantum limits, Bremermann's limit, Seth Lloyd limits...) as well as algorithmic limits (Gödel's proof and its impact on calculation, algorithmic complexity, the Chaitin's Omega number and Kolmogorov complexity, non-traditional calculations like Turing machine process and its consequences,...) and limitations arising in artificial intelligence field. The topics are (but not limited to) membrane computing, DNA computing, immune computing, quantum computing, swarm computing, analogic computing, chaos computing and computing on the edge of chaos, computational aspects of dynamics of complex systems (systems with self-organization, multiagent systems, cellular automata, artificial life,...), emergence of complex systems and its computational aspects, and agent based computation. The main aim of this series it to discuss the above mentioned topics from an interdisciplinary point of view and present new ideas coming from mutual intersection of classical as well as modern methods of computation. Within the scope of the series are monographs, lecture notes, selected contributions from specialized conferences and workshops, special contribution from international experts. More information

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Ali Sanayei · Otto E. Rössler
Ivan Zelinka
Editors

# ISCS 2014: Interdisciplinary Symposium on Complex Systems

Springer

*Editors*
Ali Sanayei
Institute for Theoretical Physics
Tübingen
Germany

Otto E. Rössler
Institute for Physical and Theoretical
Chemistry
University of Tübingen
Tübingen
Germany

Ivan Zelinka
Department of Computer Science
Faculty of Elect. Eng. and Comp.Sci.
Ostrava-Poruba
Czech Republic

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# Preface

The present book is the upshot of the "2014 Interdisciplinary Symposium on Complex Systems," held at the "Athens of the Middle Ages" as a continuation of our symposia series. Florence, birthplace of the Italian Renaissance, has a unique genius loci to it. It suffices to point to the eminent physicist who was buried there after playing here his pivotal role in the modern scientific revolution. He was a "Sire" in the word of his faithful daughter Virginia (Sister Maria Celste) and was "the father of modern physics – indeed of modern science altogether" in Einstein's words. When Galileo Galilei was 68 years old he wrote the epoch making book "A Dialogue Concerning the Two Chief World Systems: Ptolemaic and Copernican." Because of this he found himself "vehemently suspected of heresy" and got forced down on his knees to eat his words and was sentenced to permanent house arrest. He can also be seen in the tradition of an earlier more eastern school, Rumi's, which held that "there is no limit to thinking and there is a world of freedom inside every person."

In accordance with Galilei, the main aim of the symposium was to bring together many diverse points of view by scientists working on complex systems in a both divergent and convergent manner. The reader – student or professional scientist – will encounter four general categories of papers: Physical modeling of complex systems, Evolutionary computations, Complex biological systems, and Complex networks. The presentations comprise innovative ideas, philosophical overviews or state-of-the-art applications in miscellaneous fields.

At this point, we would like to express our special gratitude to our participants, our program committee, the keynote speakers (Yuri Manin, Rudolf Kalman, Karoline Wiesner and Antonio Politi), the University of Florence and the Galileo Galilei Institute for Theoretical Physics who helped us a lot to continue our symposium series in an efficient way.

The special event of this year's symposium was a "Galilei-Turing Round-table" held among our keynote speakers, accompanied by John Symons, and chaired by Barry Cooper. The round-table was devoted to diverse open problems in the physics and computation of complex systems. We accordingly dedicate the book to the memory of

Alan Turing who believed that “mathematical reasoning may be regarded rather schematically as the exercise of a combination of two facilities which we may call *intuition* and *ingenuity*.”

July 2014

Ali Sanayei
Ivan Zelinka
Otto E. Rössler

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