UNCONVENTIONAL COMPUTING, ARTS, PHILOSOPHY

Volume 2

WSPC Book Series in Unconventional Computing

Print ISSN: 2737-5218
Online ISSN: 2737-520X

Published

Vol. 2 *Unconventional Computing, Arts, Philosophy*
edited by Andrew Adamatzky

Vol. 1 *Handbook of Unconventional Computing*
(In 2 Volumes)
Volume 1: Theory
Volume 2: Implementation
edited by Andrew Adamatzky

WSPC BOOK SERIES IN UNCONVENTIONAL COMPUTING *Volume 2*

UNCONVENTIONAL COMPUTING, ARTS, PHILOSOPHY

Editor **Andrew Adamatzky**

University of the West of England, UK

World Scientific

NEW JERSEY • LONDON • SINGAPORE • BEIJING • SHANGHAI • HONG KONG • TAIPEI • CHENNAI • TOKYO

Published by

World Scientific Publishing Co. Pte. Ltd.

5 Toh Tuck Link, Singapore 596224

USA office: 27 Warren Street, Suite 401-402, Hackensack, NJ 07601

UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

Library of Congress Cataloging-in-Publication Data

Names: Adamatzky, Andrew, editor.

Title: Unconventional computing, arts, philosophy / editor, Andrew Adamatzky, University of the West of England, UK.

Description: New Jersey : World Scientific, [2023] | Series: WSPC book series in unconventional computing, 2737-520X ; 2 | Includes bibliographical references and index.

Identifiers: LCCN 2022013719 | ISBN 9789811257148 (hardcover) | ISBN 9789811257155 (ebook for institutions) | ISBN 9789811257162 (ebook for individuals)

Subjects: LCSH: Computer science--Technological innovations. | Computer simulation--Philosophy. | Natural computation. | Artificial intelligence.

Classification: LCC QA76.24 .U53 2023 | DDC 003/.3--dc23/eng/20220527

LC record available at https://lccn.loc.gov/2022013719

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library.

For any available supplementary material, please visit
https://www.worldscientific.com/worldscibooks/10.1142/12870#t=suppl

Desk Editors: Nandha Kumar/Steven Patt

Typeset by Stallion Press
Email: enquiries@stallionpress.com

Printed in Singapore

https://doi.org/10.1142/9789811257155_fmatter

Preface

Unconventional computing is about breaking boundaries in thinking, acting, and computing. Typical topics of this non-typical field include, but are not limited to, physics of computation, non-classical logics, new complexity measures, novel hardware, mechanical, chemical, and quantum computing. Unconventional computing encourages a new style of thinking while practical applications are obtained from uncovering and exploiting principles and mechanisms of information processing in, and functional properties of, physical, chemical, and living systems; in particular, efficient algorithms are developed, (almost) optimal architectures are designed, and working prototypes of future computing devices are manufactured.

The term "unconventional computing" has no exact definition. Proceeding by inclusiveness we could say that the following research topics are most commonly, but not necessarily, classified as 'unconventional': physics of computation (e.g., conservative logic, thermodynamics of computation, reversible computing, quantum computing, collision-based computing with solitons, optical logic); chemical computing (e.g., implementation of logical functions in chemical systems, image processing and pattern recognition in reaction-diffusion chemical systems, and networks of chemical reactors); bio-molecular computing (e.g., conformation based, information processing in molecular arrays, molecular memory); cellular automata as models of massively parallel computing complexity (e.g., computational complexity of non-standard computer architectures; theory of amorphous computing; artificial chemistry); non-classical logics (e.g., logical systems derived from space-time behaviour of natural systems,

logical reasoning in physical, chemical, and biological systems); smart actuators (e.g., molecular machines incorporating information processing, intelligent arrays of actuators); novel hardware systems (e.g., cellular automata VLSIs, functional neural chips); mechanical computing (e.g., micromechanical encryption, computing in nanomachines, physical limits to mechanical computation).

There are two discipline-wise paths to unconventional computing. First, you are initially trained as a mathematician or computer scientist, then you rebel and start pushing the limits of conventional science, and eventually find yourself outside the well-established tracks. Second, more common, you are trained as a chemist, biologist, physicist, then you get involved in computation and get eager to understand the meaning of information and computation in natural systems, and subsequently start realizing computing devices in novel substrates. Unconventional computing remains at the forefront of emergent technologies. This forefront is continuously changing its shape and meaning. Only static fields can be defined formally. Unconventional computing is dynamic and fluid and therefore the field defines formal definitions.

The book brought together scientists, philosophers, artists, and engineers and encouraged them to express their vision of unconventional computing in a lively informal manner. A range of ideas presented is impressively wide. A reader from any walk of life and with level of education will find topics discussed in the book exciting and inspiring.

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https://doi.org/10.1142/9789811257155_fmatter

About the Editor

Andrew Adamatzky is Professor of Unconventional Computing and Director of the Unconventional Computing Laboratory, University of the West of England Bristol, UK. He conducts research on molecular computing, reaction-diffusion computing, collision-based computing, cellular automata, slime mold computing, massive parallel computation, applied mathematics, complexity, nature-inspired optimization, collective intelligence and robotics, bionics, computational psychology, nonlinear science, novel hardware, and future and emergent computation. He has authored seven books, mostly notably *Reaction-Diffusion Computing*, *Dynamics of Crow Minds*, and *Physarum Machines*, and has edited 22 books in computing, most notably *Collision-Based Computing*, *Game of Life Cellular Automata*, *Memristor Networks*, and *Handbook in Unconventional Computing*. He has also produced a series of influential artworks published in the atlas "Silence of Slime Mould". He is Founding Editor-in-Chief of *Journal of Cellular Automata* and *Journal of Unconventional Computing* and Editor-in-Chief of *International Journal of Parallel, Emergent, Distributed Systems* and *Parallel Processing Letters*.

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https://doi.org/10.1142/9789811257155_fmatter

Contents

Preface v

About the Editor vii

1. Labyrinth: From Literature to Algorithms 1
José Félix Costa and Paula Gouveia

2. Computational Non-universality: Philosophical and Artistic Perspectives 41
Selim G. Akl

3. Natural Computation of Cognition, from Single Cells Up 57
Gordana Dodig Crnkovic

4. Are There Traces of Megacomputing in Our Universe 79
Olga Kosheleva and Vladik Kreinovich

5. Communication, Information, Energy, and Music 85
Dawid Przyczyna, Marcin Strzelecki, Gisya Abdi, Lulu Alluhaibi, Kapela Pilaka, and Konrad Szaciłowski

6. Swarms of Microscopic Agents Self-assemble into Complex Bodies 127
Bruce MacLennan

7. *Kakiwari*: The Device Summoning Creativity in Art and Cognition 135
Yukio Pegio Gunji and Kyoko Nakamura

8. What Universal Turing Machines Might Tell Us 169
Maurice Margenstern

9. A Computable Piece of Uncomputable Art Whose Expansion May Explain the Universe in Software Space 187
Hector Zenil

10. Brain-inspired Computing: Achievements and Challenges 211
Filippo Romani and Victor Erokhin

11. Novel Reversible Logic Elements for Unconventional Computing 231
Kenichi Morita

12. Logic, Stress, and Satisfaction 241
Andrew Schumann

13. Mu-Psi and Music Space: Insights into a 21st Century Music Practice 255
Cristian Vogel

14. In Search of Textile Roots of Computing: The Genesis of the First *MaSo* Carpet in India 271
Tim Otto Roth

15. Unconventional Sensing: Doing it in an Unusual Way in Unusual Settings 281
Zoran Konkoli

16. Unconventional Computing Art in Cellular Automata 291
Genaro J. Martínez, Andrew Adamatzky, and Marcin J. Schroeder

17. Extended "Beehive" Rule Cellular Automaton Dynamics on Irregular Lattices — A Preliminary Study in the Form of a Visual Catalog 305
Phil Ayres

18. The Benefits of Being Wrong: Bonding Epistemic and Cognitive Incompleteness for Natural and Artificial Intelligent Systems 315
Jordi Vallverdú

19. Formal Language of Abstract Art 321
Vladimir Murtazin

20. Conventional Non-computing and Unconventional Musical Signal Processing 339
Zlatko Baracskai

21. Exploring Chaos with Analog Computers 367
Bernd Ulmann

22. A Natural History of Networks: Softmachine 375
Ralf Baecker

23. Artists Encoding New Meanings through BioArt and Unconventional Computing 381
Hege Tapio, Kristin Bergaust, Boel Christensen-Scheel, and Stefano Nichele

24. The Cosmic Vineyard 397
Alessandro Chiolerio

25. Feral Automated System: Prototyping 405
Nikita M. Sazonov, Ippolit V. Markelov, Ekaterina B. Nikitina, Dmitriy A. Lobanov, Natalia V. Alatortseva, Dmitriy E. Kadyrov, and Mikhail M. Petrov

26. Fungal Gray Matter 423
Andrew Adamatzky, Irina Petrova, and Antoni Gandia

27. The Chemical Machine 435
Preety Anand and Grace Chung

28. Collapsing the Wave Function on Postquantum Unconventional Computing 459
Richard Mayne

29. Tactile Computing Interaction and its Application for Arts 471
Yasuhiro Suzuki

30. Complex Excitable Media: Activators Design, While Inhibitors Embellish 489
Sergio Alonso Muñoz

31. Designing Microchemical Systems Like Living Matters Induced by Interfacial Phenomena 501
Daigo Yamamoto, Erika Okita-Nawa, and Akihisa Shioi

32. Chemical Composition 511
Sarah Sebastian

33. How to Face the Complexity of the 21st Century Challenges? The Contribution of Natural Computing 513
Pier Luigi Gentili

34. An Unconventional Look at AI: Why Today's Machine Learning Systems are not Intelligent 523
Nancy Salay

35. Composing Music with Bio-Technology: An Intelligent Algorithmic Composition System Using *Physarum polycephalum*-based Memristors 535
Satvik Venkatesh, Edward Braund, and Eduardo Reck Miranda

36. The Recent Biotechnology of Tech-tattoo: An Approach from Science, Art, and Philosophy 557
Catarina Pombo Nabais

Index 573