

Lukáš Sekanina

Evolvable Components

From Theory to
Hardware Implementations



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Evolvable Components From Theory To Hardware Implementations

J. Manuel Moreno, Jordi Madrenas, Jordi Cosp



Evolvable Components From Theory To Hardware Implementations:

Evolvable Components Lukas Sekanina,2003-10-23 At the beginning of the 1990s research started in how to combine soft computing with reconfigurable hardware in a quite unique way One of the methods that was developed has been called evolvable hardware Thanks to evolutionary algorithms researchers have started to evolve electronic circuits routinely A number of interesting circuits with features unreachable by means of conventional techniques have been developed Evolvable hardware is quite popular right now more than fifty research groups are spread out over the world Evolvable hardware has become a part of the curriculum at some universities Evolvable hardware is being commercialized and there are specialized conferences devoted to evolvable hardware On the other hand surprisingly we can feel the lack of a theoretical background and consistent design methodology in the area Furthermore it is quite difficult to implement really innovative and practically successful evolvable systems using contemporary digital reconfigurable technology **Evolvable Components** Lukas Sekanina,2012-12-06 At the beginning of the 1990s research started in how to combine soft computing with reconfigurable hardware in a quite unique way One of the methods that was developed has been called evolvable hardware Thanks to evolutionary algorithms researchers have started to evolve electronic circuits routinely A number of interesting circuits with features unreachable by means of conventional techniques have been developed Evolvable hardware is quite popular right now more than fifty research groups are spread out over the world Evolvable hardware has become a part of the curriculum at some universities Evolvable hardware is being commercialized and there are specialized conferences devoted to evolvable hardware On the other hand surprisingly we can feel the lack of a theoretical background and consistent design methodology in the area Furthermore it is quite difficult to implement really innovative and practically successful evolvable systems using contemporary digital reconfigurable technology **Evolvable Systems: From Biology to Hardware** J. Manuel Moreno,Jordi Madrenas,Jordi Cosp,2005-09-19 The flying machines proposed by Leonardo da Vinci in the fifteenth century the self-reproducing automata theory proposed by John von Neumann in the middle of the twentieth century and the current possibility of designing electronic and mechanical systems using evolutionary principles are all examples of the efforts made by humans to explore the mechanisms present in biological systems that permit them to tackle complex tasks These initiatives have recently given rise to the emergent field of bio-inspired systems and evolvable hardware The inaugural workshop Towards Evolvable Hardware took place in Lausanne in October 1995 followed by the successive events of the International Conference on Evolvable Systems From Biology to Hardware held in Tsukuba Japan in October 1996 in Lausanne Switzerland in September 1998 in Edinburgh UK in April 2000 in Tokyo Japan in October 2001 and in Trondheim Norway in March 2003 Following the success of these past events the sixth international conference was aimed at presenting the latest developments in the field bringing together researchers who use biologically inspired concepts to implement real systems in artificial intelligence artificial life robotics VLSI design and related domains The sixth conference

consolidated this biennial event as a reference meeting for the community involved in bio inspired systems research All the papers received were reviewed by at least three independent reviewers thus guaranteeing a high quality bundle for ICES 2005

Evolvable Systems: From Biology to Hardware Sanyou Zeng,2007-08-26 This book constitutes the refereed proceedings of the 7th International Conference on Evolvable Systems ICES 2007 held in Wuhan China in September 2007 The 41 revised full papers collected in this volume are organized in topical sections on digital hardware evolution analog hardware evolution bio inspired systems mechanical hardware evolution evolutionary design evolutionary algorithms in hardware design and hardware implementation of evolutionary algorithms

Reconfigurable Computing Scott Hauck,André DeHon,2010-07-26 Reconfigurable Computing marks a revolutionary and hot topic that bridges the gap between the separate worlds of hardware and software design the key feature of reconfigurable computing is its groundbreaking ability to perform computations in hardware to increase performance while retaining the flexibility of a software solution Reconfigurable computers serve as affordable fast and accurate tools for developing designs ranging from single chip architectures to multi chip and embedded systems Scott Hauck and Andre DeHon have assembled a group of the key experts in the fields of both hardware and software computing to provide an introduction to the entire range of issues relating to reconfigurable computing FPGAs field programmable gate arrays act as the computing vehicles to implement this powerful technology Readers will be guided into adopting a completely new way of handling existing design concerns and be able to make use of the vast opportunities possible with reconfigurable logic in this rapidly evolving field Designed for both hardware and software programmers Views of reconfigurable programming beyond standard programming languages Broad set of case studies demonstrating how to use FPGAs in novel and efficient ways

Proceedings of the International Conference on Computing and Communication Systems Arnab Kumar Maji,Goutam Saha,Sufal Das,Subhadip Basu,João Manuel R. S. Tavares,2021-04-11 This book contains the latest research work presented at the International Conference on Computing and Communication Systems I3CS 2020 held at North Eastern Hill University NEHU Shillong India The book presents original research results new ideas and practical development experiences which concentrate on both theory and practices It includes papers from all areas of information technology computer science electronics and communication engineering written by researchers scientists engineers and scholar students and experts from India and abroad

Intelligent Systems for Automated Learning and Adaptation: Emerging Trends and Applications Chiong, Raymond,2009-09-30 This volume offers intriguing applications reviews and additions to the methodology of intelligent computing presenting the emerging trends of state of the art intelligent systems and their practical applications Provided by publisher

Knowledge-Based Intelligent Information and Engineering Systems Ignac Lovrek,Robert J.

Howlett,2008-08-18 The three volume set LNAI 5177 LNAI 5178 and LNAI 5179 constitutes the refereed proceedings of the 12th International Conference on Knowledge Based Intelligent Information and Engineering Systems KES 2008 held in

Zagreb Croatia in September 2008 The 316 revised papers presented were carefully reviewed and selected The papers present a wealth of original research results from the field of intelligent information processing in the broadest sense topics covered in the first volume are artificial neural networks and connectionists systems fuzzy and neuro fuzzy systems evolutionary computation machine learning and classical AI agent systems knowledge based and expert systems intelligent vision and image processing knowledge management ontologies and data mining Web intelligence text and multimedia mining and retrieval and intelligent robotics and control

SOFSEM 2004: Theory and Practice of Computer Science

Peter Van Emde Boas, Jaroslav Pokorný, Mária Bielíková, Julius Stüller, 2003-12-22 This book constitutes the refereed proceedings of the 30th Conference on Current Trends in Theory and Practice of Computer Science SOFSEM 2004 held in Měrná Czech Republic in January 2004 The volume presents 10 invited lectures and 22 full papers selected from 136 submissions Among the topics covered are computer science theory programming theory database systems information systems cognitive technologies and Web technologies

Field Programmable Logic and Application Jürgen Becker, Marco Platzner, Serge Vernalde, 2004-08-11 This book contains the papers presented at the 14th International Conference on Field Programmable Logic and Applications FPL held during August 30th September 1st 2004 The conference was hosted by the Interuniversity Micro Electronics Center IMEC in Leuven Belgium The FPL series of conferences was founded in 1991 at Oxford University UK and has been held annually since in Oxford 3 times Vienna Prague Darmstadt London Tallinn Glasgow Villach Belfast Montpellier and Lisbon It is the largest and oldest conference in reconfigurable computing and brings together academic researchers industry experts users and newcomers in an informal welcoming atmosphere that encourages productive exchange of ideas and knowledge between the delegates The fast and exciting advances in field programmable logic are increasing steadily with more and more application potential and need New ground has been broken in architectures design techniques partial run time reconfiguration and applications of field programmable devices in several different areas Many of these recent innovations are reported in this volume The size of the FPL conferences has grown significantly over the years FPL in 2003 saw 216 papers submitted The interest and support for FPL in the programmable logic community continued this year with 285 scientific papers submitted demonstrating a 32% increase when compared to the year before The technical program was assembled from 78 selected regular papers 45 additional short papers and 29 posters resulting in this volume of proceedings The program also included three invited plenary keynote presentations from Xilinx Gilder Technology Report and Altera and three embedded tutorials from Xilinx the University of Karlsruhe TH and the University of Oslo

Applications of Evolutionary Computing

Günther R. Raidl, Stefano Cagnoni, Jürgen Branke, David W. Corne, Rolf Drechsler, Yaochu Jin, Colin G. Johnson, Penousal Machado, Elena Marchiori, Franz Rothlauf, George D. Smith, Giovanni Squillero, 2004-03-09 Evolutionary Computation EC deals with problem solving optimization and machine learning techniques inspired by principles of natural evolution and netics Just from this basic definition it is clear that one of

the main features of the research community involved in the study of its theory and its applications is multidisciplinary. For this reason EC has been able to draw the attention of an ever increasing number of researchers and practitioners in several fields. In its 6 year long activity EvoNet the European Network of Excellence in Evolutionary Computing has been the natural reference and incubator for that multifaceted community. EvoNet has provided logistic and material support for those who were already involved in EC but in the first place it has had a critical role in favoring the significant growth of the EC community and its interactions with longer established ones. The main instrument that has made this possible has been the series of events first organized in 1998 that have spanned over both theoretical and practical aspects of EC. Ever since 1999 the present format in which the EvoWorkshops a collection of workshops on the most application oriented aspects of EC act as satellites of a core event has proven to be very successful and very representative of the multidisciplinary of EC. Up to 2003 the core was represented by EuroGP the main European event dedicated to Genetic Programming. EuroGP has been joined as the main event in 2004 by EvoCOP formerly part of EvoWorkshops which has become the European Conference on Evolutionary Computation in Combinatorial Optimization.

Bio-Inspired Technologies for the Hardware of Adaptive Systems Mircea Gh. Negoita, Sorin Hintea, 2009-01-21. Evolvable Hardware (EHW) has emerged as a sub domain of artificial evolution represented by a design methodology consortium of methods involving the application of Evolutionary Algorithms (EA) to the synthesis of digital and analogue electronic circuits and systems. Nevertheless the most benefit for the society and indeed most revolutionizing application of EA is its hardware implementation leading to the EHW. These new EA based methodologies led to a new type of machines that is evolved to attain a desired behaviour which means they have a behavioural computational intelligence. EHW is a special case of the adaptive hardware namely being strongly related to the Adaptive Systems (AS) and the Adaptive Hardware (AH). The book presents a careful selection of the field that very well reflects the breadth of this high technology and its terminology and applications in context of the AS/AH. The harmonious symbiosis of the engineering approach and the accurate scientific methodology features the aspects of highly relevant and practical design principles governing the development of EHW and its connections with AS/AH. This book is both attractive and useful for everybody interested in the design and analysis of EHW in context of AS/AH and implementation of real time adaptive hardware hybrid intelligent systems.

Evolvable Designs of Experiments Octavian Iordache, 2009-02-11. Adopting a groundbreaking approach the highly regarded author shows how to design methods for planning increasingly complex experiments. He begins with a brief introduction to standard quality methods and the technology in standard electric circuits. The book then gives numerous examples of how to apply the proposed methodology in a series of real life case studies. Although these case studies are taken from the printed circuit board industry the methods are equally applicable to other fields of engineering.

Cartesian Genetic Programming Julian F. Miller, 2011-09-18. Cartesian Genetic Programming (CGP) is a highly effective and increasingly popular form of genetic programming. It represents programs in the form of

directed graphs and a particular characteristic is that it has a highly redundant genotype phenotype mapping in that genes can be noncoding. It has spawned a number of new forms each improving on the efficiency among them: modular or embedded CGP and self-modifying CGP. It has been applied to many problems in both computer science and applied sciences. This book contains chapters written by the leading figures in the development and application of CGP and it will be essential reading for researchers in genetic programming and for engineers and scientists solving applications using these techniques. It will also be useful for advanced undergraduates and postgraduates seeking to understand and utilize a highly efficient form of genetic programming.

Genetic and Evolutionary Computation for Image Processing and Analysis Stefano Cagnoni, 2008

Unconventional Computation Christian S. Calude, Jose Felix Gomes da Costa, Nachum Dershowitz, Elisabete Freire, Grzegorz Rozenberg, 2009-09-01. This book constitutes the refereed proceedings of the 8th International Conference on Unconventional Computation UC 2009 held in Ponta Delgada, Portugal, in September 2009. The 18 revised full papers presented together with 8 invited talks, 3 tutorials and 5 posters were carefully reviewed and selected from 40 submissions. The papers are devoted to all aspects of unconventional computation ranging from theoretical and experimental aspects to various applications. Typical topics are natural computing including quantum cellular molecular neural and evolutionary computing, chaos and dynamical system based computing and various proposals for computational mechanisms that go beyond the Turing model.

Inspired by Nature Susan Stepney, Andrew Adamatzky, 2017-10-25. This book is a tribute to Julian Francis Miller's ideas and achievements in computer science, evolutionary algorithms and genetic programming. Leading international experts in computing inspired by nature offer their insights into the principles of information processing and optimisation in simulated and experimental living physical and chemical substrates. Miller invented Cartesian Genetic Programming (CGP) in 1999 from a representation of electronic circuits he devised with Thomson a few years earlier. The book presents a number of CGP's wide applications including multi-step ahead forecasting, solving artificial neural networks, dogma approximation, computing medical informatics, control engineering, evolvable hardware and multi-objective evolutionary optimisations. The book addresses in depth the technique of Evolution in Materiality, a term coined by Miller and Downing, using a range of examples of experimental prototypes of computing in disordered ensembles of graphene nanotubes, slime, mould, plants and reaction-diffusion chemical systems. Advances in sub-symbolic artificial chemistries, artificial bio-inspired development, code evolution with genetic programming and using Reed-Muller expansions in the synthesis of Boolean quantum circuits add a unique flavour to the content. The book is a pleasure to explore for readers from all walks of life, from undergraduate students to university professors, from mathematicians, computer scientists and engineers to chemists and biologists.

Genetic Programming Theory and Practice II Una-May O'Reilly, Tina Yu, Rick Riolo, Bill Worzel, 2006-03-16. The work described in this book was first presented at the Second Workshop on Genetic Programming Theory and Practice organized by the Center for the Study of

Complex Systems at the University of Michigan Ann Arbor 13-15 May 2004 The goal of this workshop series is to promote the exchange of research results and ideas between those who focus on Genetic Programming GP theory and those who focus on the application of GP to various real world problems In order to facilitate these interactions the number of talks and participants was small and the time for discussion was large Further participants were asked to review each other's chapters before the workshop Those reviewer comments as well as discussion at the workshop are reflected in the chapters presented in this book Additional information about the workshop addendums to chapters and a site for continuing discussions by participants and by others can be found at <http://cscs.umich.edu/8000/GPTP/2004/> We thank all the workshop participants for making the workshop an exciting and productive three days In particular we thank all the authors without whose hard work and creative talents neither the workshop nor the book would be possible We also thank our keynote speakers Lawrence Dave Davis of NuTech Solutions Inc Jordan Pollack of Brandeis University and Richard Lenski of Michigan State University who delivered three thought provoking speeches that inspired a great deal of discussion among the participants

Genetic Programming Marc Ebner, 2007-04-02 This book constitutes the refereed proceedings of the 10th European Conference on Genetic Programming EuroGP 2007 held in Valencia Spain in April 2007 colocated with EvoCOP 2007 The 21 revised plenary papers and 14 revised poster papers were carefully reviewed and selected from 71 submissions The papers address fundamental and theoretical issues along with a wide variety of papers dealing with different application areas

Genetic Programming Michael O'Neill, 2008-03-14 This book constitutes the refereed proceedings of the 11th European Conference on Genetic Programming EuroGP 2008 held in Naples Italy in March 2008 colocated with EvoCOP 2008 The 21 revised plenary papers and 10 revised poster papers were carefully reviewed and selected from a total of 61 submissions A great variety of topics are presented reflecting the current state of research in the field of genetic programming including the latest work on representations theory operators and analysis evolvable hardware agents and numerous applications

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