Tetsuya Higuchi Masaya Iwata Weixin Liu (Eds.)

Evolvable Systems: From Biology to Hardware

First International Conference, ICES96 Tsukuba, Japan, October 7-8, 1996 Proceedings



Contents

Invited Talks

Iconic Learning in Networks of Logical Neurons
Hardware Requirements for Fast Evaluation of Functions Learned by Adaptive Logic Networks
FPGA as a Key Component for Reconfigurable System
Overview
Phylogeny, Ontogeny, and Epigenesis: Three Sources of Biological Inspiration for Softening Hardware
Promises and Challenges of Evolvable Hardware
Evolware
Designing Evolware by Cellular Programming
Online Autonomous Evolware

Speeding-up Digital Ecologies Evolution Using a Hardware Emulator: Preliminary Results
Pierre Marchal, Pascal Nussbaum, Christian Piguet, and Moshe Sipper
Challenges of Evolvable Systems: Analysis and Future Directions
Cellular Systems
Functional Organisms Growing on Silicon
Logical Universality and Self-Reproduction in Reversible Cellular Automata
Engineering Applications of EHW
Data Compression Based on Evolvable Hardware
ATM Cell Scheduling by Function Level Evolvable Hardware
Weixin Liu, Masahiro Murakawa, and Tetsuya Higuchi
Evolutionary Robotics
An Evolutionary Robot Navigation System Using a Gate-Level Evolvable Hardware

Genetic Evolution of a Logic Circuit which Controls an
Autonomous Mobile Robot
Taku Naito, Ryoichi Odagiri, Yutaka Matsunaga, Manabu Tanifuji,
and Kazuyuki Murase
Autonomous Robot with Evolving Algorithm Based on
Biological Systems
Jun Yamamoto and Yuichiro Anzai
Memory-Based Neural Network and Its Application to a Mobile
Robot with Evolutionary and Experience Learning
Hidetaka Ito and Tatsumi Furuya
Innovative Architectures
Multiple Genetic Algorithm Processor for Hardware
Optimization
Mehrdad Salami
NGEN: A Massively Parallel Reconfigurable Computer for
Biological Simulation: Towards a Self-Organizing Computer 260
John S. McCaskill, Thomas Maeke, Udo Gemm, Ludger Schulte,
and Uwe Tangen
Architecture of Cell Array Neuro-Processor
Takayuki Morishita and Iwao Teramoto
Special-Purpose Brainware Architecture for Data
Processing
Tadashi Ae, Hikaru Fukumoto, and Saku Hiwatashi

Evolvable Systems

Evolvable Hardware: An Outlook	305
Bernard Manderick and Tetsuya Higuchi	
Reuse, Parameterized Reuse, and Hierarchical Reuse of Substructures in Evolving Electrical Circuits Using Genetic Programming	. 312
John R. Koza, Forrest H. Bennett III, David Andre, and Martin A. Keane	
Machine Learning Approach to Gate-Level Evolvable Hardware	. 327
Hitoshi Iba, Masaya Iwata, and Tetsuya Higuchi	
	. 344
Ricardo S. Zebulum, Marco Aurélio Pacheco, and Marley Vellasco	
From some Tasks to Biology and then to Hardware Jan Kazimierczak	359
Evolvable Hardware	
Adaptive Equalization of Digital Communication Channels Using Evolvable Hardware Masahiro Murakawa, Shuji Yoshizawa, and Tetsuya Higuchi	. 379
An Evolved Circuit, Intrinsic in Silicon, Entwined with Physics	. 390
Adrian Thompson	
Through the Labyrinth Evolution Finds a Way: A Silicon Ridge	. 406
innan itai vey ana itai an itnompson	

Hardware Evolution System Introducing Dominant and Recessive Heredity	423
Tomofumi Hikage, Hitoshi Hemmi, and Katsunori Shimohara	J
CAM-Brain: A New Model for ATR's Cellular Automata Based Artificial Brain Project	7
Felix Gers and Hugo de Garis	
Genetic Programming	
Evolution of a 60 Decibel Op Amp Using Genetic	
Programming	5
Evolution of Binary Decision Diagrams for Digital Circuit	_
Design Using Genetic Programming	0
Hidenori Sakanashi, Tetsuya Higuchi, Hitoshi Iba, and Yukinori Kakazu	
Author Index48	3