CONTENTS

Preface

Emergent computation: self-organizing, collective, and cooperative phenomena in natural and artificial computing networks. Introduction to the Proceedings of the Ninth Annual CNLS Conference	1 5
S. Forrest	1
Computation at the edge of chaos: phase transitions and emergent computation C.G. Langton	12
The performance of cooperative processes B.A. Huberman	38
Collective behavior of predictive agents J.O. Kephart, T. Hogg and B.A. Huberman	48
Toward diagnosis as an emergent behavior in a network ecosystem R.A. Maxion	66
The complex behavior of simple machines R. Machlin and Q.F. Stout	85
Computer arithmetic, chaos and fractals J. Palmore and Ch. Herring	99
The Coreworld: emergence and evolution of cooperative structures in a computational chemistry S. Rasmussen, C. Knudsen, R. Feldberg and M. Hindsholm	111
Requirements for evolvability in complex systems: orderly dynamics and frozen components S.A. Kauffman	135
A Rosetta Stone for connectionism J.D. Farmer	153
Concerning the emergence of tag-mediated lookahead in classifier systems J.H. Holland	188
Learning and bucket brigade dynamics in classifier systems M. Compiani, D. Montanari and R. Serra	202
Emergent behavior in classifier systems S. Forrest and J.H. Miller	213
Co-evolving parasites improve simulated evolution as an optimization procedure W.D. Hillis	228
Computer symbiosis – emergence of symbiotic behavior through evolution T. Ikegami and K. Kaneko	235
Using genetic search to exploit the emergent behavior of neural networks J.D. Schaffer, R.A. Caruana and L.J. Eshelman	244
Perceptron redux: emergence of structure S.W. Wilson	249

Contents

An energy function for specialization W. Banzhaf and H. Haken	257
A stochastic version of the delta rule S.J. Hanson	265
Synchronous or asynchronous parallel dynamics. Which is more efficient? I. Kanter	273
On the nature of explanation: a PDP approach P.M. Churchland	281
Parallel simulated annealing techniques D.R. Greening	293
Geometric learning algorithms S.M. Omohundro	307
The emergence of understanding in a computer model of concepts and analogy-making M. Mitchell and D.R. Hofstadter	322
The symbol grounding problem S. Harnad	335
Selectionist models of perceptual and motor systems and implications for functionalist theories of brain function	
G.N. Reeke Jr. and O. Sporns	347
Bifurcation and category learning in network models of oscillating cortex B. Baird	365
Non-linear dynamical system theory and primary visual cortical processing R.M. Siegel	385
A dynamical system view of cerebellar function J.D. Keeler	396
Neuromagnetic studies of human vision: noninvasive characterization of functional neural architec- ture	
J.S. George, C.J. Aine and E.R. Flynn	411
Computational connectionism within neurons: a model of cytoskeletal automata subserving neural networks	
S. Rasmussen, H. Karampurwala, R. Vaidyanath, K.S. Jensen and S. Hameroff	428
List of contributors	450

Analytic subject index

¢

•

(

451