

Bibliography

- [1] B. Al-Kazemi and C. K. Mohan. Multi-Phase Generalization of the Particle Swarm Optimization Algorithm. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 489 – 494, Honolulu, Hawaii, 12 - 17 May 2002.
- [2] P. J. Angeline. Using Selection to Improve Particle Swarm Optimization. In *Proceedings of the IEEE International Joint Conference on Neural Networks*, pages 84 – 89, July 1999.
- [3] T. Bäck, D. B. Fogel, and T. Michalewicz, editors. *Basic Algorithms and Operators*, volume 1 of *Evolutionary Computation*. Institute of Physics Publishing, Bristol and Philadelphia, 1999.
- [4] D. Beasley, D. R. Bull, and R. R. Martin. A Sequential Niching Technique for Multimodal Function Optimization. *Evolutionary Computation*, 1(2):101 – 125, 1993.
- [5] C. Blake, E. Keogh, and C. J. Merz. UCI Repository of Machine Learning Databases, 2002. University of California, Irvine, Department of Information and Computer Sciences, <http://www.ics.uci.edu/~MLRepository.html>.
- [6] E. Cantu-Paz. A Summary of Research on Parallel Genetic Algorithms. Technical report, Genetic Algorithm Lab, Urbana, University of Illinois, Illinois, July 1995. IlliGAL Rep. 95007.
- [7] A. Carlisle and G. Dozier. Adapting Particle Swarm Optimization to Dynamic Environments. In *Proceedings of the IEEE International Conference on Artificial Intelligence*, pages 429 – 434, Las Vegas, USA, 2000.

- [8] A. Carlisle and G. Dozier. An Off-The-Shelf PSO. In *Proceedings of the Workshop on PSO*, Indianapolis, IN, USA, 2001. Purdue School of Engineering and Technology, IUPUI.
- [9] A. Carlisle and G. Dozier. Tracking Changing Extrema with Particle Swarm Optimizer. Technical report, Auburn University, Alabama, USA, 2001. Technical Report CSSE01-08.
- [10] D. L. Carroll. Genetic Algorithms and Optimizing Chemical Oxygen-Iodine Lasers. In R. Batra, C. Bert, A. Davis, R. Shapery, D Stewart, and F. Swinson, editors, *Developments in Theoretical and Applied Mechanics*, volume XVIII, pages 411 – 424. School of Engineering, University of Alabama, 1996.
- [11] N. Christianini and J. Shawne-Taylor. *An Introduction to Support Vector Machines and Other Kernel-Based Learning Methods*. Cambridge University Press, 2000.
- [12] A. Cichocki and R. Unbehauen. Neural Networks for Solving Systems of Linear Equations and Related Problems. *IEEE Transactions on Circuits and Systems–I: Fundamental Theory and Applications*, 39(2), February 1992.
- [13] M. Clerc and J. Kennedy. The Particle Swarm – Explosion, Stability and Convergence in a Multidimensional Complex Space. *IEEE Transactions on Evolutionary Computation*, 6(1):58 – 73, February 2002.
- [14] C. A. Coello Coello. An Updated Survey of Evolutionary Multiobjective Optimization Techniques: State of the Art and Future Trends. In *Proceedings of the IEEE Congress on Evolutionary Computation*, pages 3 – 13, Washington, DC, July 1999.
- [15] C. A. Coello Coello and M. S. Lechuga. MOPSO: A Proposal for Multiple Objective Particle Swarm Optimization. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1051 – 1056, Honolulu, Hawaii, May 2002.
- [16] A. Conradie, R. Miikulainen, and C. Aldrich. Adaptive Control utilising Neural Swarming. In *Proceedings of the Genetic and Evolutionary Computation Conference*, New York, USA, 2002.

- [17] A. Conradie, R. Miikulainen, and C. Aldrich. Intelligent Process Control utilising Symbiotic Memetic Neuro-Evolution. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 623 – 628, Honolulu, Hawaii, 12 - 17 May 2002.
- [18] A. Conradie, I. Nieuwoudt, and C. Aldrich. Nonlinear Neurocontroller Development with Evolutionary Reinforcement Learning. In *9th National Meeting of SAIChe*, Secunda, South Africa, 2002.
- [19] K. A. de Jong. *An Analysis of the Behavior of a Class of Genetic Adaptive Systems*. PhD thesis, Department of Computer Science, University of Michigan, Ann Arbor, Michigan, USA, 1975.
- [20] K. Deb. Genetic Algorithms in Multimodal Function Optimization. Master's thesis, Department of Engineering Mathematics, University of Alabama, 1989.
- [21] R. C. Eberhart and X. Hu. Human Tremor Analysis Using Particle Swarm Optimization. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1927 – 1930, Washington DC, USA, July 1999.
- [22] R. C. Eberhart and Y. Shi. Comparing Inertia Weights and Constriction Factors in Particle Swarm Optimization. In *Proceedings of the IEEE Congress on Evolutionary Computation*, pages 84 – 89, San Diego, USA, 2000.
- [23] R. C. Eberhart and Y. Shi. Tracking and Optimizing Dynamic Systems with Particle Swarms. In *Proceedings of the IEEE Congress on Evolutionary Computation*, pages 94 – 100, Seoul, Korea, 2001.
- [24] A. P. Engelbrecht. *Computational Intelligence: An Introduction*. Wiley and Sons, October 2002.
- [25] A. P. Engelbrecht and A. Ismail. Training Product Unit Neural Networks. *Stability and Control: Theory and Applications*, 2(1-2):59 – 74, 1999.
- [26] J. B. Fraleigh and R. A. Beauregard. *Linear Algebra*. Addison Wesley Publishing Company, 3rd edition, 1995.

- [27] B. Gabrys and A. Bargiela. Neural Simulation of Water Systems for Efficient State Estimation. *Proceedings of the European Simulation Multiconference*, pages 775 – 779, 1995.
- [28] J. Gan and K. Warwick. A Variable Radius Niche Technique for Speciation in Genetic Algorithms. In *Proceedings of the Genetic and Evolutionary Computation Conference*, pages 96 – 103. Morgan-Kaufmann, 2000.
- [29] J. Gan and K. Warwick. Dynamic Niche Clustering: A Fuzzy Variable Radius Niching Technique for Multimodal Optimization in GAs. In *Proceedings of the IEEE Congress on Evolutionary Computation*, volume I, pages 215 – 222, 2001.
- [30] J. Gan and K. Warwick. Modelling Niches of Arbitrary Shape in Genetic Algorithms using Niche Linkage in the Dynamic Niche Clustering Framework. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 43 – 48, Honolulu, Hawaii, 12 - 17 May 2002.
- [31] D. E. Goldberg. *Genetic Algorithms in Search, Optimization and Machine Learning*. Addison Wesley, Reading, MA, 1989.
- [32] D. E. Goldberg and J. Richardson. Genetic Algorithm with Sharing for Multimodal Function Optimization. In *Proceedings of the Second International Conference on Genetic Algorithms*, pages 41 – 49, 1987.
- [33] D. E. Goldberg and L. Wang. Adaptive Niching via Coevolutionary Sharing. Technical report, Genetic Algorithm Lab, Urbana, University of Illinois, Illinois, August 1997. IlliGAL Rep. 97007.
- [34] P. Grosso. *Computer Simulations of Genetic Application: Parrallel Subcomponent Interaction in a Multilocus Model*. PhD thesis, University of Michigan, USA, 1985.
- [35] G. R. Harik. Finding Multimodal Solutions Using Restricted Tournament Selection. Technical report, IlliGAL, University of Illinois at Urbana-Champaign, Urbana, Illinois, 1995.

- [36] J. Holland. *Adaptation in Natural and Artificial Systems*. University of Michigan Press, Ann Arbor, Michigan, USA, 1975.
- [37] J. Horn. *The nature of niching: Genetic algorithms and the evolution of optimal, cooperative populations*. PhD thesis, Urbana, University of Illinois, Illinois, Genetic Algorithm Lab, 1997.
- [38] X. Hu and R. Eberhart. Multiobjective Optimization using Dynamic Neighborhood Particle Swarm Optimization. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1677 – 1681, Honolulu, Hawaii, 12 - 17 May 2002.
- [39] X. Hu and R. C. Eberhart. Tracking Dynamic Systems with PSO: Where's the Cheese? In *Proceedings of the Workshop on Particle Swarm Optimization*, Purdue School of Engineering and Technology, Indianapolis, USA, 2001.
- [40] X. Hu and R. C. Eberhart. Adaptive Particle Swarm Optimization: Detection and Response to Dynamic Systems. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1666 – 1670, Honolulu, Hawaii, May 2002.
- [41] D. S. Huang and Z. Chi. Neural Networks with Problem Decomposition for Finding Real Roots of Polynomials. In *Proceedings of the IEEE International Joint Conference on Neural Networks*, volume Addendum, pages 25 – 30, Washington DC, 15-19 July 2001.
- [42] D. S. Huang and Z. Chi. Solving Linear Simultaneous Equations by Constraining Learning Neural Networks. In *Proceedings of the IEEE International Joint Conference on Neural Networks*, volume Addendum, pages 26 – 31, Washington DC, 15-19 July 2001.
- [43] K. Hwang and S. Cho. Evolving Diverse Hardwares Using Speciated Genetic Algorithm. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 437–442, Honolulu, Hawaii, 12 - 17 May 2002.
- [44] A. Ismail and A. P. Engelbrecht. Training Product Units in Feedforward Neural Networks using Particle Swarm Optimization. *Proceedings of the International Conference on Artificial Intelligence*, pages 36 – 40, 1999.

- [45] C. Z. Janikow and Z. Michalewicz. An Experimental Comparison of Binary and Floating Point Representations in Genetic Algorithms. In *Proceedings of the 4th International Conference on Genetic Algorithms*, pages 31 – 36. Morgan Kaufmann, San Diego, USA, 1991.
- [46] Y. Jin, T. Okabe, and B. Sendhoff. Dynamic Weighted Aggregation for Evolutionary Multiobjective Optimization: Why Does It Work and How? In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO'2001)*, pages 1042 – 1049, San Francisco, USA, 2001.
- [47] J. Kennedy. Small Worlds and Mega-Minds: Effects of Neighborhood Topology on Particle Swarm Performance. *Proceedings of the IEEE Congress on Evolutionary Computation*, pages 1931 – 1938, July 1999.
- [48] J. Kennedy. Stereotyping: Improving Particle Swarm Performance with Cluster Analysis. In *Proceedings of the IEEE Congress on Evolutionary Computation*, pages 1507 – 1512, San Diego, USA, 2000.
- [49] J. Kennedy and R. C. Eberhart. Particle Swarm Optimization. In *Proceedings of the IEEE International Conference on Neural Networks*, volume IV, pages 1942 – 1948, Perth, Australia, 1995.
- [50] J. Kennedy and R. C. Eberhart. A Discrete Binary Version of the Particle Swarm Algorithm. In *Proceedings of the Conference on Systems, Man and Cybernetics*, pages 4104 – 4109, 1997.
- [51] J. Kennedy and R. Mendes. Population Structure and Particle Swarm Performance. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1671 – 1676, Honolulu, Hawaii, May 2002.
- [52] J. Kennedy and W. M. Spears. Matching Algorithms to Problems: An Experimental Test of the Particle Swarm and some Genetic Algorithms on the Multimodal Problem Generator. In *Proceedings of the IEEE World Congress on Computational Intelligence*, pages 78 – 83, Anchorage, Alaska, 1998.

- [53] K. Kim and S. Cho. Evolving Speciated Checkers Players with Crowding Algorithm. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 407 – 412, Honolulu, Hawaii, 12 - 17 May 2002.
- [54] J. D. Knowles and D. W. Corne. Approximating the Nondominated Front Using the Pareto Archived Evolution Strategy. *Evolutionary Computation*, 8(2):149 – 172, 2000.
- [55] T. Krink, J. K. Vesterstrøm, and J. Riget. Particle Swarm Optimization with Spatial Particle Extension. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1474 – 1479, Honolulu, Hawaii, 12 - 17 May 2002.
- [56] R. A. Krohling, H. Knidel, and Y. Shi. Solving Numerical Equations of Hydraulic Problems Using Particle Swarm Optimization. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1688 – 1690, Honolulu, Hawaii, 12 - 17 May 2002.
- [57] E. C. Laskarski, K. E. Parsopoulos, and M. N. Vrahatis. Particle Swarm Optimization for Integer Programming. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1582 – 1587, Honolulu, Hawaii, 12 - 17 May 2002.
- [58] E. C. Laskarski, K. E. Parsopoulos, and M. N. Vrahatis. Particle Swarm Optimization for Minimax Problems. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1576 – 1581, Honolulu, Hawaii, 12 - 17 May 2002.
- [59] M. Løvbjerg and T. Krink. Extending Particle Swarm Optimizers with Self-Organized Criticality. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1588 – 1593, Honolulu, Hawaii, May 2002.
- [60] M. Løvbjerg, T. K. Rasmussen, and T. Krink. Hybrid Particle Swarm Optimizer with Breeding and Subpopulations. In *Proceedings of the Genetic and Evolutionary Computation Conference*, volume 1, pages 469 – 476, San Fransisco, USA, July 2001.
- [61] S. W. Mahfoud. *Niching Methods for Genetic Algorithms*. PhD thesis, Genetic Algorithm Lab, University of Illinois, Illinois, 1995. IlliGAL Rep. 95001.

- [62] S.W. Mahfoud. A Comparison of Parallel and Sequential Niching Methods. In *Proceedings of the Sixth International Conference on Genetic Algorithms*, pages 136 – 143, 1995.
- [63] E. Mayr. *Animal Species and Evolution*. Belknap, Cambridge, MA, 1963.
- [64] R. Mendes, P. Cortez, M. Rocha, and J. Neves. Particle Swarms for Feedforward Neural Network Training. In *Proceedings of the IEEE Joint Conference on Neural Networks*, pages 1895 – 1899, Honolulu, Hawaii, 12 – 17 May 2002.
- [65] O. J. Mengshoel and D. E. Goldberg. Probabilistic Crowding: Deterministic Crowding with Probabilistic Replacement. In *Proceedings of the Genetic and Evolutionary Computation Conference 1999*, pages 409 – 416, San Fransisco, USA, Morgan Kaufmann, 1999.
- [66] B. L. Miller and M. J. Shaw. Genetic Algorithms with Dynamic Niche Sharing for Multimodal Function Optimization. Technical report, Genetic Algorithm Lab, Urbana, University of Illinois, Illinois, December 1995. IlliGAL Rep. 95010.
- [67] N. J. Nilsson. *Artificial Intelligence: A New Synthesis*. Morgan Kaufmann Publishers, Inc, 1998.
- [68] E. Ozcan and C. K. Mohan. Analysis of a Simple Particle Swarm Optimization System. In *Intelligent Engineering Systems Through Artificial Neural Networks*, volume 8, pages 253 – 258, 1998.
- [69] E. Ozcan and C. K. Mohan. Particle Swarm Optimization : Surfing the Waves. In *Proceedings of the International Congress on Evolutionary Computation*, pages 1939 – 1944, Washington, USA, 1999.
- [70] U. Paquet. Training Support Vector Machines with Particle Swarms. Master's thesis, Department of Computer Science, University of Pretoria, Pretoria, South Africa, 2002.
- [71] K. E. Parsopoulos, V. P. Plagianakos, G. D. Magoulas, and M. N. Vrahatis. Stretching Technique for Obtaining Global Minimizers Through Particle Swarm Optimiza-

- tion. In *Proceedings of the Particle Swarm Optimization Workshop*, pages 22 – 29, Indianapolis, USA, 2001.
- [72] K. E. Parsopoulos and M. N. Vrahatis. Modification of the Particle Swarm Optimizer for Locating all the Global Minima. In V. Kurkova, N.C. Steele, R. Neruda, and M. Karny, editors, *Artificial Neural Networks and Genetic Algorithms*, pages 324 – 327. Springer, 2001.
- [73] K. E. Parsopoulos and M. N. Vrahatis. Particle Swarm Optimization in Noisy and Continuously Changing Environments. In M. H. Hamza, editor, *Artificial Intelligence and Soft Computing*, pages 289 – 294. IASTED/ACTA, Anaheim, USA, 2001.
- [74] K. E. Parsopoulos and M. N. Vrahatis. Particle Swarm Optimization Method for Constrained Optimization. In P. Sincak, J. Vascak, V. Knasnicka, and J. Pospichal, editors, *Intelligent Technologies – Theory and Applications: New Trends in Intelligent Technologies*, volume 76, pages 214 – 220. IOS Press, 2002.
- [75] K. E. Parsopoulos and M. N. Vrahatis. Particle Swarm Optimization Method in Multiobjective Problems. In *Proceedings of the 2002 ACM Symposium on Applied Computing (SAC 2002)*, pages 603 – 607, 2002.
- [76] M. A. Potter. *The Design and Analysis of a Computational Model of Cooperative Coevolution*. PhD thesis, George Mason University, Fairfax, Virginia, USA, 1997.
- [77] W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery. *Numerical Recipes in C: The Art of Scientific Computing*. Cambridge University Press, second edition, 1992.
- [78] W. C. Rheinboldt. *Methods for Solving Systems of Nonlinear Equations*. Society for Industrial & Applied Mathematics, second edition, 1998.
- [79] J. D. Schaffer. Multiple Objective Optimization with Vector Evaluated Genetic Algorithms. pages 93 – 100, 1985.

- [80] Y. Shi and R. C. Eberhart. A Modified Particle Swarm Optimizer. In *Proceedings of the IEEE World Conference on Computational Intelligence*, pages 69 – 73, Anchorage, Alaska, May 1998.
- [81] Y. Shi and R. C. Eberhart. Fuzzy Adaptive Particle Swarm Optimization. In *Proceedings of the 2001 Congress on Evolutionary Computation*, pages 101 – 106, Seoul, Korea, 27-30 May 2001.
- [82] Y. Shi and R. C. Eberhart. Particle Swarm Optimization with Fuzzy Adaptive Inertia Weight. In *Proceedings of the Workshop on Particle Swarm Optimization*, Purdue School of Engineering and Technology, Indianapolis, USA, 2001.
- [83] Y. Shi and R. A. Krohling. Co-evolutionary Particle Swarm Optimization to Solve min-max Problems. In *Proceedings of the IEEE World Congress on Evolutionary Computation*, pages 1682 – 1687, Honolulu, Hawaii, 12 - 17 May 2002.
- [84] W. M. Spears. Simple Subpopulation Schemes. In *Proceedings of the Evolutionary Programming Conference*, pages 296 – 307, 1994.
- [85] P. N. Suganthan. Particle Swarm Optimizer with Neighborhood Operator. *Proceedings of the IEEE Congress on Evolutionary Computation*, pages 1958 – 1961, July 1999.
- [86] E. Thiémar. Economic Generation of Low-Discrepancy Sequences with a b-ary Gray Code. Department of Mathematics, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland.
- [87] F. van den Bergh. *An Analysis of Particle Swarm Optimizers*. PhD thesis, Department of Computer Science, University of Pretoria, Pretoria, South Africa, 2002.
- [88] F. van den Bergh and A. P. Engelbrecht. Cooperative Learning in Neural Networks using Particle Swarm Optimizers. *South African Computer Journal*, 26:84 – 90, November 2000.
- [89] F. van den Bergh and A. P. Engelbrecht. Training Product Unit Networks using Cooperative Particle Swarm Optimizers. In *Proceedings of the IEEE International*

Joint Conference on Neural Networks, pages 126 – 132, Washington DC, USA, July 2001.

- [90] F. van den Bergh and A. P. Engelbrecht. A New Locally Convergent Particle Swarm Optimizer. *Accepted for IEEE Conference on Systems, Man and Cybernetics*, October 2002.
- [91] J. S. Vesterstrøm, J. Riçet, and T. Krink. Division of Labor in Particle Swarm Optimization. In *Proceedings of the IEEE World World Congress on Evolutionary Computation*, pages 1570 – 1575, Honolulu, Hawaii, May 2002.

Appendix A

Derived Publications

This appendix lists all the papers that have been published, or are currently under review, that were derived from work done in this thesis.

1. R. Brits, A.P. Engelbrecht and F. van den Bergh. Solving Systems of Unconstrained Equations using Particle Swarm Optimization. *IEEE International Conference on Systems, Man and Cybernetics*, Hammamet, Tunisia, October 2002.
2. R. Brits, A.P. Engelbrecht and F. van den Bergh. A Niching Particle Swarm Optimizer. *Conference on Simulated Evolution and Learning*, Singapore, November 2002.
3. R. Brits, A.P. Engelbrecht and F. van den Bergh. Particle Swarm Niching. Submitted to *IEEE Transactions on Evolutionary Computation*.
4. R. Brits, A.P. Engelbrecht and F. van den Bergh. Scalability of Niche PSO. Submitted to *IEEE Swarm Intelligence Symposium 2003*.