

ERIK D. GOODMAN

Professor, Electrical and Computer Engineering; Professor, Mechanical Engineering
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Chair, ACM SIGEVO, Special Interest Group on Genetic and Evolutionary Computation

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EDUCATION

1972 Ph.D., Computer and Communication Sciences, University of Michigan, Ann Arbor
1968 M.S., Systems Science, Michigan State University
1966 B.S., High Honors, Mathematics, Michigan State University

EMPLOYMENT HISTORY

1972 – 1984 Asst. Prof., Assoc. Prof., Electrical and Computer Engineering, Michigan State University
1983 – 2002 Director, A. H. Case Center for Computer-Aided Engineering and Manufacturing
1984 – Professor, Electrical and Computer Engineering
1992 – Professor, Mechanical Engineering
1993 – 2003 Director, MSU Manufacturing Research Consortium
1993 – Co-Director, Genetic Algorithms Research and Applications Group ("GARAGE")

HONORS AND REPRESENTATIVE PROFESSIONAL ACTIVITIES

Senior Fellow, International Society for Genetic and Evolutionary Computation, 2004; Advisory Professor, East China Normal University (Shanghai, PRC); Advisory Professor, Tongji University (Shanghai, PRC); Honorary Doctorate, Dnieprodzerzhinsk State Technical Univ. (Ukraine); Academician, National Academy of Engineering of Ukraine; Academician, Internat. Academy of Informatization (Moscow); MSU Alumni Distinguished Scholar, NSF Trainee, NASA Trainee, IBM Fellowship; Phi Kappa Phi, Sigma Xi, Omicron Delta Kappa, Pi Mu Epsilon, Phi Eta Sigma; Withrow Exceptional Service Award, 2004 (College of Engineering, MSU).

Chair, ACM Special Interest Group on Genetic and Evolutionary Computation (SIGEVO), Jan., 2005 -2008; Chair, Internat. Society for Genetic and Evolut. Computation, 2001-2004; Gen. Chair, Genetic and Evolut. Computation Conference, 2001; member, Exec. Board, Internat. Soc. for Genetic and Evolut. Computation, 2000 – 2008; Gen.Chair, Seventh Internat. Conf. on Genetic Algorithms (July, 1997); Exec. Ctee., Int'l Soc. for Genetic Algorithms, 1997-2000; Gen. Chair, First Internat. Conf. on Evolutionary Computation and its Applications (Moscow, June, 1996); edit. board member: *Evolutionary Computation, Int. J. of Applied Intelligence, Journal of Applied Soft Computing*; senior member, Soc. of Mfg. Engineers member, Am. Inst. of Aeronautics and Astronautics -- CAD/CAM Technical Committee (Outstanding Contributions Award, 1990), chaired Research & New Directions Subcttee, 1987-88, chaired Conferences & Workshops Subcommittee, 1988-89; General Chair, 1987 International Computer Graphics Conference, co- sponsored by SAE and Engineering Society of Detroit; member, IEEE Computer Society; Society of Automotive Engineers (SAE); charter member, Society for Env'tal Toxicol. and Chem.; consultant to several companies.

FUNDED RESEARCH

Initiated/directed/co-directed funded research projects with present value (inflation-adjusted) over \$7 million, excluding funding of consortia administered, from sources including National Science Foundation, U.S. Environmental Protection Agency, General Dynamics, General Motors, Chrysler, Ford, CIMLINC, and SDRC) in these areas:

Parallel genetic algorithms (“PGA’s”) for automated design of automotive and aerospace metal and composite structures; genetic programming for design of bond graphs describing mechatronic systems; tools/training to improve performance of globally distributed engineering design teams; PGA’s for planning and scheduling of manufacturing operations; PGA’s for nesting of 2-D irregular parts; toolpath verification algorithms for CNC milling machines; simulation of robotic spray application on sculptured surfaces; environmentally responsible manufacturing; CAD surface conversion algorithms; CAD in athletic biomechanics; modeling, simulation, and field studies of biological and environmental systems.

Directed additional consortial research of over \$2 million, with additional spinoffs.

TEACHING SUMMARY:

Developed and taught SYS 442, Systems Concepts for Biologists, 1972-1981; companion graduate course SYS 843 teamed undergrads, graduate students and faculty to model organisms, populations, or ecosystems.

Developed EE 431, Computer Interfacing, capstone course with associated laboratory projects, 1980-1983.

Taught undergraduate electric circuits and discrete-time systems courses, 1980's.

Redeveloped and taught ECE 381, engineering ethics, communications, and professionalism, 1996-99.

Enhanced and taught ECE 480, senior capstone design, with industrially sponsored projects, 2002-present, including addition of ECE Design Day, public presentation day near end of each semester, 2004-present.

Developed and co-taught CSE 848, Evolutionary Computation, with W. Punch, even years, 2000-2004.

Mentored 8 undergraduate research assistants or professorial assistants.

Advised 14 Ph.D.'s, guided 10 post-docs or sabbatical faculty researchers; guided 9 biology Ph.D. students' mathematical modeling work; served on 35 Ph.D. committees; supervised 14 M.S. theses; hosted six visiting scholars.

PUBLICATION SUMMARY:

Two books co-authored; 3 conference proceedings co-edited; journal special issue guest-edited; 13 chapters in books; over 130 papers in journals/proceedings, 5 software packages commercialized or widely distributed.

SELECTED RECENT PUBLICATIONS

2005

- J. Hu, R. Rosenberg and E. Goodman, “Domain Specificity of Genetic Programming Based Automated Synthesis: A Case Study with Synthesis of Mechanical Vibration Absorbers,” chapter in T. Yu, R. Riolo, and B. Worzel (eds.), *Genetic Programming Theory and Practice III*, Springer, New York, November, 2005, pp. 275-290.
- J. Hu and E. Goodman. “Evolving robust dynamic systems with genetic programming,” *Genetic Programming Theory and Practice II*, R. Riolo and W. Worzel (eds.), Kluwer Academic Publishers, Boston, January, 2005, pp. 143-158.
- J. Hu, E. Goodman, K. Seo, Z. Fan, and R. Rosenberg, "The Hierarchical Fair Competition (HFC) Framework for Sustainable Evolutionary Algorithms," *Evolutionary Computation*, 13(2), 2005, pp. 241-277.
- J. Wang, Z. Fan, J. Terpenney, and E. Goodman, “Knowledge Interaction with Genetic Programming in Mechatronic Systems Design Using Bond Graphs,” *IEEE Transactions on Systems, Man and Cybernetics, Part C: Applications and Reviews, Special Issue on Knowledge Extraction and Incorporation in Evolutionary Computation*, 35(2), 2005, pp 172-182.

- J. Hu, X. Zhong, E. Goodman, "Open-Ended Robust Design of Analog Filters Using Genetic Programming," *Proc. Genetic & Evolutionary Computation Conference-2005 (GECCO-2005)*, Volume 2, ACM Press, June, 2005, Washington, DC, pp. 1619-1626 [nominated for Best Paper Award].
- H. Firpi, E. Goodman and J. Echaiz, "Epileptic Seizure Detection by Means of Genetically Programmed Artificial Features," *Proc. Genetic & Evolutionary Computation Conference-2005 (GECCO-2005)*, Volume 1, ACM Press, June, 2005, Washington, DC, pp. 461-466.
- Z. Fan, M. Andreasen, J. Wang, E. Goodman and Lars Hein," Towards an evolvable chromosome model for interactive computer design support," *Proc. Internat. Conf. on Engineering Design (ICED05)*, Melbourne, Australia, Aug. 15-18, 2005.
- H. Firpi, E. Goodman, and J. Echaiz, "On Prediction of Epileptic Seizures by Computing Multiple Genetic Programming Artificial Features," *Proc. 8th European Conference on Genetic Programming*, Lecture Notes in Computer Science, Springer, Lausanne, Switzerland, March, 2005, pp. 321-330.
- Z. Fan, J. Wang, and E. Goodman, "An Evolutionary Approach For Robust Layout Synthesis of MEMS," *Proc. IEEE/ASME Int. Conf. on Advanced Intelligent Mechatronics*, Monterey, CA, July 24-28, 2005, pp. 1186-1191.
- E. Goodman, "Strategies for Design Optimization: Lessons from Automotive Systems," invited paper in *Proceedings, Evolutionary Computation in Practice Track, Genetic & Evolutionary Computation Conference-2005 (GECCO-2005)*, sponsored by ACM SIGEVO, June, 2005, Washington, DC, 39pp.

2004

- Jianjun Hu, Erik Goodman, Kisung Seo, and Ronald Rosenberg, "Toward Efficient Topological Synthesis of Dynamic Systems Using Bond Graphs and Genetic Programming," chapter in Nedjah, Nadia (ed.), *Evolutionary Machine Design: Methodology and Application*, a book in Series on Intelligent Systems Engineering, Nova Science Publishers, 2004.
- Zhun Fan, Jiachuan Wang, and Erik Goodman, "Exploring Open-Ended Design Space of Mechatronic Systems," *Internat. J. of Advanced Robotic Systems*, 1(4), pp. 295-302, Dec., 2004.
- Zhun Fan, Kisung Seo, Jianjun Hu, Erik Goodman, Ronald Rosenberg, "A Novel Evolutionary Engineering Design Approach for Mixed-Domain Systems," in *J. Engineering Optimization*, Volume 36, Number 2, 2004.
- Bulent Buyukbozkirli and Erik Goodman, "A Statistical Model of GA Dynamics for the OneMax Problem," *Proc. 2004 Genetic and Evolutionary Computation Conference, Lecture Notes in Computer Science*, Springer, June, 2004, Seattle, WA, Part I, pp. 935-946.
- Jianjun Hu, Erik Goodman, and Ronald Rosenberg, "Robust and Efficient Genetic Algorithms with Hierarchical Niching and a Sustainable Evolutionary Computation Model," *Proc. 2004 Genetic and Evolutionary Computation Conference, Lecture Notes in Computer Science*, Springer, June, 2004, Seattle WA, Part I, pp. 1220-1232.
- E. Goodman, "Introduction to Genetic Algorithms," in Tutorial Proceedings, Genetic & Evolutionary Computation Conference-2005 (GECCO-2005), sponsored by ACM SIGEVO, June, 2005, Washington, DC, 19pp.
- Z. Fan, J. Wang, and E. Goodman, "Exploring Open-Ended Design Space of Mechatronic Systems," *Internat. J. of Advanced Robotic Systems*, 1(4), pp. 295-302, Dec., 2004.
- Z. Fan, K. Seo, J. Hu, E. Goodman, R. Rosenberg, "A Novel Evolutionary Engineering Design Approach for Mixed-Domain Systems," in *J. Engineering Optimization*, Volume 36, Number 2, 2004.
- H. Firpi and E. Goodman, "Designing Templates for Cellular Neural Networks Using Particle Swarm Optimization," 33rd Applied Imagery Pattern Recognition Workshop 2004, Washington DC, Oct. 13-15, 2004, pp. 119-123.
- H. Firpi and E. Goodman, "Swarmed feature selection," 33rd Applied Imagery Pattern Recognition Workshop 2004, Washington DC, Oct. 13-15, 2004, pp.112-118.

2000-2003

- Jianjun Hu, Erik Goodman, and Kisung Seo, "Continuous Hierarchical Fair Competition Model for Sustainable Innovation in Genetic Programming," chapter in *Genetic Programming Theory and Practice*, R. Riolo and W. Worzel, (eds.), Kluwer Academic Publishers, 2003, pp. 81-98. December, 2003.
- K. Seo, J. Hu, Z. Fan, E. D. Goodman, and R. C. Rosenberg, " Automated Design Approaches for Multi-Domain Dynamic Systems Using Bond Graphs and Genetic Programming," *International Journal of Computers, Systems and Signals*, vol.3, no.1, pp.55-70, 2002.

- J. Hu, E. D. Goodman, K. Seo, M. Pei, "Adaptive Hierarchical Fair Competition (AHFC) Model for Parallel Evolutionary Algorithms," *Proc. Genetic and Evolutionary Computation Conference, GECCO-2002*, New York, July, 2002, pp. 772-779.
- J. Hu, K. Seo, S. Li, Z. Fan, R. C. Rosenberg, E. D. Goodman, "Structure Fitness Sharing (SFS) for Evolutionary Design by Genetic Programming," *Proc. Genetic and Evolutionary Computation Conference, GECCO-2002*, New York, July, 2002, pp. 780-787.
- Z. Fan, K. Seo, R. C. Rosenberg, J. Hu, E. D. Goodman, "Exploring Multiple Design Topologies using Genetic Programming and Bond Graphs", *Proc. Genetic and Evolutionary Computation Conference, GECCO-2002*, New York, July, 2002, pp. 1073-1080.
- Radzevich, Stephen P. and Goodman, Erik D., "Computation of Optimal Workpiece Orientation for Multi-axis NC Machining of Sculptured Part Surfaces," *ASME Journal of Mechanical Design*, Vol. 124, pp. 201-212, June, 2002.
- J. Hu and E. D. Goodman, "The Hierarchical Fair Competition Model for Parallel Evolutionary Algorithms," *Proc. 2002 IEEE World Congress on Computational Intelligence*, Congress on Evolutionary Computation, Honolulu, HI, pp. 49-54, May, 2002.
- L. Spector, E. Goodman, *et al.*, eds., *Proceedings of the Genetic and Evolutionary Computation Conference, 2001*, July 7-11, Morgan Kaufmann Publishers, San Francisco, 1463pp.
- R. Averill, D. Eby, and E. Goodman, "How Well Can It Take a Hit?" *Mechanical Engineering Design*, American Society of Mechanical Engineers, New York, March, 2001, pp. 26-28.
- E. Goodman, J. Lloyd, T. Hinds, "Organizing Student Engineering Design Team Collaboration with Russia," *Proc. Internat. Conf. on Engineering Education*, Oslo, Norway, Aug. 6-10, 2001.
- M. Raymer, W. Punch, L. Kuhn, E. Goodman, and A. Jain, "Dimensionality Reduction Using Genetic Algorithms," *IEEE Trans. Evol. Computat.*, vol. 4, no. 2, July, 2000, pp. 164-171.

1999 and Earlier

- D. Eby, R. C. Averill, E. Goodman, W. Punch, "Optimal Design of Flywheels Using an Injection Island Genetic Algorithm," *Artificial Intelligence in Engineering Design, Analysis and Manufacturing*, 13, 1999, pp. 389-402.
- S. Radzevitch, E. Goodman, "Efficiency of Multi-Axis NC Machining of Sculptured Part Surfaces," in *Machining Impossible Shapes*, G. Olling, B. Choi, R. Jerard, eds., Kluwer Academic Publishers, Norwell, Mass., 1999, pp.42-58.
- I. Norenkov, E. Goodman, "Solving Scheduling Problems via Evolutionary Methods for Rule Sequence Optimization," *Soft Computing in Engineering Design and Manufacture*, P. K. Chawdry, *et al.*, eds., Springer, 1998, pp. 350-355.
- A. Ligun, A. Shumeiko, S. Radzevitch, E. Goodman, "Asymptotically Optimum Recovery of Smooth Contours by Bezier Curve," *Computer-Aided Geometric Design*, 15, 1998, pp. 495-506.
- S. Radzevitch, E. Goodman, "About the Orthogonal Parameterization of Sculptured Part Surfaces and Initial Tool Surfaces," *ASME Journal of Manufacturing Science and Engineering*, 119 (4(B)), November, 1997, pp. 823-828.
- M. Raymer, P. Sanschagrin, W. Punch, S. Venkataraman, E. Goodman, L. Kuhn, "Predicting Conserved Water-Mediated and Polar Ligand Interactions in Proteins using a K-nearest-neighbor Genetic Algorithm," *Journal of Molecular Biology*, 265(4), Jan. 1997, pp. 445-464.
- S.-C. Lin, E. Goodman, W. Punch, "A Genetic Algorithm Approach to Dynamic Job Shop Scheduling Problems," *Proc. 7th Internat. Conf. on Genetic Alg.*, East Lansing, MI, Morgan Kaufmann, San Francisco, 1997, pp. 481-488.
- A. Ligun, A. Shumeiko, S. Radzevitch, E. Goodman, "Asymptotically Optimal Disposition of Tangent Points for Approximation of Smooth Convex Surfaces by Polygonal Functions," *Computer-Aided Geometric Design*, 14, 1997, pp. 533-546.
- E. Goodman, V. Uskov, W. Punch, eds., *Proc. First International Conference on Evolutionary Computation and its Applications*, Institute for High-Performance Computer Systems, Russian Academy of Sciences, Moscow, 1996.
- W. Punch, D. Zongker, E. Goodman, "The Royal Tree Problem, a Benchmark for Single and Multi-population Genetic Programming," in *Advances in Genetic Programming 2*, MIT Press, Cambridge, Mass., 1996, pp. 299-316.
- M. Raymer, W. Punch, E. Goodman, L. Kuhn, "Genetic Programming for Improved Data Mining -- Application to the Biochemistry of Protein Interactions," *Genetic Programming '96*, July, 1996, pp. 375-381.
- R. Averill, C.-S. Lin, Y. Ding, Y. Yip, W. Punch, E. Goodman, "Optimal Design of Laminated Composite Structures Using Coarse-Grain Parallel Genetic Algorithms," *Computing Systems in Engineering*, 5(4), 1995, pp. 415-423.

- S.-C. Lin, W. F. Punch, E. Goodman, "Coarse-Grain Parallel Genetic Algorithms: Categorization and New Approach," *IEEE Conference on Parallel and Distributed Processing*, Nov., 1994.
- W. F. Punch, M. Pei, R. Enbody, C.-S. Lai, P. Hovland, E. Goodman, "Further Research on Feature Selection and Classification Using Genetic Algorithms," *Proc. Fifth Internat. Conf. on Genetic Algorithms and their Applications*, Morgan Kaufman, pp. 557-564, 1993.
- A. V. Sannier, E. Goodman, "Midgard: A Genetic Approach to Adaptive Load Balancing for Distributed Systems," *Machine Learning*, 1988, pp. 174-180.