

## Jerry E. Pratt

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Institute for Human and Machine Cognition  
40 South Alcaniz Street  
Pensacola, FL 32502

### Professional Interest:

To understand, produce, and control systems that exhibit interesting dynamical interactions, including various electro-mechanical devices, legged robots, and biological systems. Specific areas of research interests include:

- Biologically Inspired Unmanned Underwater Vehicle Design and Control
- Bipedal Walking: Modeling, Simulation, Control
- Powered Prosthetics, Exoskeletons
- Bipedal Walking and Running Robots, Quadrupedal Galloping Robots
- Advanced Control Systems
- Artificial Life, Natural Computation

### Education

- Massachusetts Institute of Technology
  - Ph.D. Electrical Engineering and Computer Science. 2000
  - M.Eng. Electrical Engineering and Computer Science 1995
  - B.S. Mechanical Engineering 1994
  - B.S. Electrical Engineering and Computer Science 1994

### Experience

- Research Scientist. (April 2002 – Present). Institute for Human and Machine Cognition. Researching bipedal walking and quadrupedal running control, robotics, and assistive devices.
- President and CEO, Yobotics, Inc. (January 2000 – April 2002.). Co-founder of robotics startup company specializing in powered prosthetics, biomimetic robots, muscle-like actuators, simulation software, and robotic consulting. Generated over \$500,000 in revenue.
- Research Assistant (June 1994 – June 2000), Prof. Gill Pratt, Department of Electrical Engineering and Computer Science, M.I.T. Designed, constructed, and controlled various bipedal walking robots. Developed advanced control techniques for robotic systems.
- Undergraduate Research Assistant (May 1993 – June 1994), Prof. Chris Atkeson, Department of Brain and Cognitive Science, M.I.T. Designed and built vision and support systems for autonomous helicopter research.
- Mechanical Engineer (June 1992 – August 1992), Timken Research, Canton OH. Designed and built a system for detecting the initiation and propagation of spalls on rolling contact fatigue steel samples.
- Undergraduate Research Assistant (May 1991 – January 1992), Prof. David Tennenhouse, Department of Electrical Engineering and Computer Science, M.I.T. Designed, built, and tested interfaces for connecting DEC 5000 and SUN Workstations to a high-speed network switch concurrently under design.

## Funded Research Grant Proposals

- Co-author: “Quadrupedal Robot that can Walk, Trot, Gallop, and Jump”, ARMY/TARDEC SBIR, Phase I and II. 2003-2004.
- PI: “Naval Automation and Information Management Technology”, ONR, 2002-2004.
- Contributing author: “Visually Guided Running and Scrambling Robots for Tactical Urban Environments”, DARPA/TTO BAA 98-08, 1998-2000.

## Selected Projects

1. Power-autonomous Legged robot for Urban Terrain Operations (PLUTO). (2003-Present). Developing control algorithms for gas powered monopedal and quadrupedal robots.
2. RoboWalker (2001-2002). Co-designed, and developed control algorithms for a powered lower body orthotic device that enhances one’s strength and endurance during walking.
3. Agile Robot Arm. (2000-2001). Electronics and Software engineer for a seven degree of freedom force-controllable robot arm.
4. Yobotics! Simulation Construction Set. (2000-2002): Project Manager and chief engineer on the development of a software package for simulating robots.
5. M2 (1998-2000): Co-designed, simulated, and performed control studies for a 3D, seven link, twelve degree of freedom bipedal walking robot.
6. Spring Flamingo (1996-2000): Designed, constructed, and controlled a seven link, six degree of freedom planar bipedal walking robot that can walk quickly (1.2 m/s) and can walk over rolling terrain. Demonstrated the benefits of exploiting natural dynamics in the control of bipedal robots.
7. Spring Turkey (1994-1996): Masters Thesis Project. Co-designed and controlled a five link, four degree of freedom planar bipedal walking robot. Developed a motion control tool called Virtual Model Control that helps simplify the control of walking robots.
8. Reinforcement Learning (1999): Area Exam. “Elephants Don’t Play Backgammon, Either”. Demonstrated that Reinforcement Learning is equivalent to brute force search of Traditional AI plus stochastic dynamics. Implemented various Reinforcement Learning algorithms on a Pong Game.
9. Artificial Life Simulations (1998): Implemented various simulations of Diffusion Limited Aggregation, Cell Differentiation, and an Artificial Ecosystem.
10. Genetic Algorithms and Central Pattern Generators (1997): Implemented a Genetic Algorithm for tuning the parameters of a Central Pattern Generator that controlled a simulated multi-link “Recti-Blob” robot. Integrated the Genetic Algorithm code into the Leg Lab’s Creature Library dynamic simulation package.
11. Video Production and Editing (1994-2002): Scripted, produced, and edited various Lab and company distribution videos.
12. Web Pages (1994-2002): Designed, constructed and maintain the M.I.T Leg Laboratory web page: [www.ai.mit.edu/projects/leglab/](http://www.ai.mit.edu/projects/leglab/), and Yobotics web page: [www.yobotics.com/](http://www.yobotics.com/)
13. Whizzy Vision (1994): Undergrad Thesis Project. Designed and built a general-purpose robotic control and vision system which included a color blob tracker and frame grabber. Could track a model helicopter at 30Hz with a precision of 1cm over 10 meters.

14. Knock Out Keyless Door Lock (1990): Invented, designed, and built a keyless door lock that recognizes a programmable sequence of knocks. Won Grand prize in the 1990 Design a Duracell Device Scholarship Competition.

### **Skills**

- Control Theory: Robust, Adaptive, Multi-Variable, Non-Linear, Linear, Signal Processing, Neural Networks.
- Project Management.
- Reinforcement Learning, Artificial Intelligence, Genetic Algorithms, Neural Oscillators.
- Machine Design: SolidWorks, ProEngineer.
- Programming: Java, C, LISP, Assembly, Matlab, Maple, Latex, HTML.
- Circuit Design and Layout: SPICE, OrCAD.
- Project Planning, Budgeting, Scheduling, and Documentation.
- Writing, Teaching, Communicating to the Public.
- Machining, Woodworking, Quick Prototyping.
- Video Production, Digital and Analog.

### **Teaching Experience**

- M.I.T. Course 6.894, “Legged Locomotion in Robots and Animals”
  - Lecturer: Fall 1999
  - Lecturer: Spring 1996

### **Students Supervised**

- John Carff, University of West Florida, 2003-2004.
- Jim Warrenfeltz, summer internship, 2002, “Genetic Algorithm Development for Tuning Legged Robots”
- Ann Torres, B.S. Mech. Eng. 1996, “Virtual Model Control of a Hexapod Walking Robot”
- Mike Wittig, B.S. Mech Eng. 1996, “The Design and Construction of a Modular Force Control Actuator”

### **Selected Publications**

- Jerry E. Pratt, Benjamin T. Krupp, Christopher J. Morse, and Steven H. Collins, 2004. *The RoboKnee: An Exoskeleton for Enhancing Strength and Endurance During Walking*. Proceedings of the 2004 IEEE International Conference on Robotics and Automation (ICRA '04), New Orleans, LA, 2430-2435.
- Peter D. Neuhaus, Michael O’Sullivan, David Eaton, John Carff, and Jerry E. Pratt, 2004. *Concept Designs for Underwater Swimming Exoskeletons*. Proceedings of the 2004 IEEE International Conference on Robotics and Automation (ICRA '04), New Orleans, LA, 4893-4898.
- D. J. Paluska and J. E. Pratt, 2003. Bipedal Walking Robots in *Biomimetic Robotics*, Brezeal, C. and Yoseph Bar-Cohen, Ed., SPIE Press, 228-252.
- Jerry Pratt, Ben Krupp, and Chris Morse, 2002. Series elastic actuators for high fidelity force control. *Industrial Robot Journal*, Vol. 29, No. 3, pp. 234-241
- Jerry Pratt. 2002. Bipedal Walking Robots: Advancing the Science through Killer Applications, Replication and Validation, Standards and Common Platforms, and

Competition. Proceedings of the 2002 FIRA Robot World Congress, Seoul, Korea, May 26-29, 2002. pp. 111-114.

- Jerry E. Pratt, Chee-Meng Chew, Ann Torres, Peter Dilworth, Gill Pratt, 2001. *An Intuitive Approach for Bipedal Locomotion*. International Journal of Robotics Research, 20:(2), 129-143.
- Jerry E. Pratt, 2000. Exploiting Inherent Robustness and Natural Dynamics in the Control of Bipedal Walking Robots. PhD. Thesis, MIT Computer Science. June 2000.
- Chee-Meng Chew, Jerry E. Pratt, Gill A. Pratt. 1999. *Blind Walking of a Planar Bipedal Robot on Sloped Terrain*. Proceedings of IEEE International Conference on Robotics and Automation (ICRA '99), Detroit, Michigan.
- Jerry E. Pratt, Gill A. Pratt. 1999. *Exploiting Natural Dynamics in the Control of a 3D Bipedal Walking Simulation*. Proceedings of the International Conference on Climbing and Walking Robots (CLAWAR99), Portsmouth, UK, September 1999
- David W. Robinson, Jerry E. Pratt, Daniel J. Paluska, Gill A. Pratt. 1999. *Series Elastic Actuator Development for a Biomimetic Walking Robot*. IEEE/ASME International Conference on Advanced Intelligent Mechatronics, Sept. 19-22, 1999. Atlanta, GA.
- Jerry E. Pratt, Gill A. Pratt. 1998. *Intuitive Control of a Planar Bipedal Walking Robot*. Proceedings of the IEEE International Conference on Robotics and Automation (ICRA '98), Leuven, Belgium 1998.
- Jerry E. Pratt, Peter C. Dilworth, Gill A. Pratt. 1997. *Virtual Model Control of a Bipedal Walking Robot*. Proceedings of the IEEE International Conference on Robotics and Automations (ICRA '97), Albuquerque, NM. 1997.
- Jerry E. Pratt, Ann L. Torres, Peter C. Dilworth, Gill A. Pratt. 1996. *Virtual Actuator Control*. Proceedings of the IEEE International Conference on Intelligent Robots and Systems (IROS '96), Osaka, Japan.
- Gill A. Pratt, Matt M. Williamson, Peter C. Dilworth, Jerry E. Pratt, Karsten Ulland, Anne Wright 1995. *Stiffness Isn't Everything*. Proceedings of ISER '95, Stanford CA.

#### **Invited Talks and Workshops, Program Committees**

- Workshop: "Introducing the HUROSOT Simulation League Competition". 2002 FIRA Robot World Congress. Seoul, Korea, May 2002.
- Jerry Pratt, 2002, *Bipedal Walking Robots: Advancing the Science through Killer Applications, Replication and Validation, Standards and Common Platforms, and Competitions*, Proceedings of the 2002 FIRA Robot World Congress, pp. 111-114. Seoul, Korea, May 2002.
- Jerry E. Pratt, Gill A. Pratt. 1998. *Exploiting Natural Dynamics in the Control of a Planar Bipedal Walking Robot*. Proceedings of the Thirty-Sixth Annual Allerton Conference on Communication, Control, and Computing, Monticello, IL, September 1998.
- International Advisory Committee: International Conference on Climbing and Walking Robots (CLAWAR 99).

#### **Journal and Grant Reviews**

- National Institute for Disability and Rehabilitation Research (NIDRR), Dept. of Education.
- International Journal of Robotics Research.

- IEEE Transaction on Robotics and Automation.
- IEEE International Conference on Robotics and Automation.
- IEEE/ASME Transactions on Mechatronics.
- IEEE Transactions on Control Systems Technology

### **Community Service**

- Assisting in the development and execution of the IHMC “Science Saturday’s” informal science education program.
- Scientific American Frontiers “Ask The Scientists”
- Reply to dozens of emails per year from grade school and high school students who inquire about robots and engineering.
- Active member of Progress 2020, a group of young professionals engaged in various local issues affecting Pensacola, FL.

### **Patents**

- “A Spring-Loaded, Counterbalancing Hoist”, Pending.