

## CURRICULUM VITAE

# AMIR SHAPIRO, Ph.D.

Updated: January 25, 2006

### PERSONAL INFORMATION

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- Citizenship: Israel
- Date and place of birth: October 24<sup>th</sup> 1971, Haifa, Israel
- Family status: Married, Four children
- Languages: Hebrew, English
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### ACADEMIC DEGREES

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- Ph.D., Mechanical Engineering,  
Technion-Israel Institute of Technology, Haifa, Israel      March 21<sup>st</sup> 2004
- M.Sc., Mechanical Engineering,  
Technion-Israel Institute of Technology, Haifa, Israel      March 15<sup>th</sup> 2000
- B.Sc., Cum-Laude, Mechanical Engineering,  
Technion-Israel Institute of Technology, Haifa, Israel      April 1997
- Practical Engineer, Agricultural Engineering,  
Ort Emek-Harod Practical Engineering and high school      July 1990

### ACADEMIC APPOINTMENTS

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- **Lecturer**, Mechanical Engineering Department, Ben Gurion University of the Negev. Conducting research in robotics. Teaching courses in Robotics and Mechatronics.      April 2005 - Present
- **Post-Doctoral Fellow**, Robotics Institute, Carnegie Mellon University. Conducting research on mobile snake-like robots and in medical robotics.      September 2005 - September 2006
- **Post-Doctoral Fellow**, Mechanical Engineering Department, Ben Gurion University of the Negev. Conducting research in robotics. Teaching courses in Robotics and Mechatronics.      March 2004 - March 2005
- **Teaching Assistant**, Mechanical Engineering Department, Technion – Israel Institute of Technology. Assisted instructor in teaching several courses in Dynamics, Robotics and Mechatronics.      1997 - 2004

## HONORS AND AWARDS

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- Biography included in Who's Who in Engineering Academia January 2007
- Biography included in Who's Who in Science and Engineering 2006-2007 May 2006
- Excellence in teaching October 2005
- The Barazani prize for outstanding Ph.D. thesis June 2004
- The Salim and Rachel Benin scholarship (Ph.D.) March 2003
- Two excellence scholarships from the Technion (Ph.D.) Feb. 2000 – Jan. 2001
- Special Gutwirth scholarship (M.Sc.) March 29<sup>th</sup> 1999
- Included in the President's List (B.Sc.) 1996
- Included in the Dean's List (B.Sc.) 1993-1996
- Excellence scholarship from the Ministry of Education (Practical Engineering) 1990

## CONSULTING

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- Maof Developments, Tirat-Tzvi, Israel.
- GeBA Gene Bio Application Ltd, Kfar Hanagid Israel.
- Mop-Line, Merhavia, Israel.
- Ter-Arme, Natanyah, Israel.
- Generic Imaging, Nofit, Israel.

## TEACHING EXPERIENCE

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- **Advisor** of undergraduate projects:
  1. Development of a system to rescue people from skyscrapers, 2004-2005
  2. Development of a wall climbing robot, 2004-2005
  3. Dynamics of a Tomcar based autonomous vehicle, 2004-2005
  4. Eye – Hand coordination for a robotic arm with a camera, 2004-2005
  5. Development of strings based parallel robot, 2005-2006
- Spring 2005 **Lecturer** (Ben Gurion University): Kinematics and Dynamics of Robots course (undergraduate)
- **Lecturer** (Ben Gurion University): Theory of Machines course (undergraduate)
- Fall 2004-2005 **Lecturer** (Ben Gurion University): Mechatronics course (graduate and undergraduate)
- **Lecturer** (J&S College): Robot Design and Programming course (undergraduate)
- Summer 2004 **Lecturer** (J&S College): Engineering Design course (undergraduate)
- Spring 2004 **Lecturer** (Ben Gurion University): Kinematics and Dynamics of Robots course (undergraduate)
- Fall 2003-2004 **Lecturer** (Technion): Introduction to Mechatronics course (undergraduate).
- 1997-2003 **Teaching Assistant** (Technion) in the following courses
  - Dynamics (undergraduate).
  - Introduction to Mechatronics (undergraduate).
  - Electric Drives (undergraduate).
  - Robots Navigation (graduate).

- Laboratory in Mechanics and Control (undergraduate).
- 2000-2004 **Project Advisor** (Technion) in the following multi-students projects
  - ROBOCUP – Robots soccer team
  - Party Robot – Robot that dances and serve drinks in parties

## **MILITARY SERVICE**

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- 1990-1993 Served as a Project Engineer in the Technological branch of the Israeli army.

## **RESEARCH INTERESTS**

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- Locomotion of multi-limbed mechanisms in unstructured complex environments
- Navigation Algorithms for multi-limbed robots
- Non-Linear control algorithms for multi-limbed robots
- Robot grasping design, control, and stability analysis
- Locomotion of snake like robots
- Climbing of snake like robots
- Design of special robotics structures
- Multi-Robot on-line motion planning
- Medical robotics

## **PROFESSIONAL ACTIVITIES**

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- Session chair: 2006 IEEE International Conference on Robotics & Automation
- Member , Institute of Electrical and Electronics Engineering.
- Member of Editorial Consultant Board of the International Journal of Advanced Robotic Systems - from January 2006
- Israel Ministry of Science & Technology, reviewer of research proposals
- Reviewer: Mechanism and Machine Theory
- Reviewer: IEEE Transactions on Robotics
- Reviewer: IEEE Transactions on Robotics and Automation
- Reviewer: International Journal of Robotics Research
- Reviewer: Autonomous Robots journal published by Kluwer academic publishers
- Reviewer: IEEE International Conference on Robotics & Automation
- Reviewer: IEEE/RSJ International Conference on Intelligent Robots and Systems
- Reviewer: IASTED International Conference on Robotics and Applications

## **GRADUATE STUDENTS**

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### **In Progress**

- Shahr Sarid, Master's. Thesis title: multi robot motion planning. Supervisor: Amir Shapiro
- Pavel Zilberman, Master's. Thesis title: Development of a four legged walking robot. Supervisor: Amir Shapiro.
- Avi Manor, Master's. Thesis title: Design and control of a five degrees of freedom machine tool based on three degrees of freedom parallel manipulator.

## RESEARCH GRANTS

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- BGU: Yael Edan, Ohad Ben-Shachar, Amir Shapiro. Slovenia: Marko Hoevar, Brane irok, Matevz Dular, Tom Bajcar, Niko Herakovic, Dragica Noe, Viktor Jecic, Tone Godea, Toma Poje, Denis Stajnko, Miran Lakota, "*Development of a robotic system for targeted spraying in orchards and vineyards*" Source: Slovenian-Israeli Research Cooperation in Biotechnology, Robotics, Advanced Materials. Total requested grant: \$40,940. Period: December 2006- December 2008.
- Israel: Yael Edan, Amir Shapiro, Ohad Ben Shahar, Avital Bechar, Dutch: Jochen Hemming, Eldert van Henten. "*A new approach to future farming: small and light-weight agrobots*". Source: Workshop Proposal for the Third Call of the Joint Dutch-Israeli Agricultural Science and Technology Program. Total grant: €12,360 Euro, Period: September 2006 – August 2007.
- Amir Shapiro, Ohad Ben-Shahar, Yael Edan, David Shapiro, Baruch Luzon, Boris Bordman, "*A Robotic Apparatus for Spraying and Pollinating Date Palm Trees*". Source: ICA-Israel Colonization Association. Total grant: \$18,000. Period: May 2006 – December 2007.
- Amir Shapiro, Ariel Felner, Ohad Ben-Shahar, Solomon Eyal Shimony, Hugo Gutterman, "*Request to purchase research equipment at USA*". Source: Directorate of Defense Research & Development, Ministry of Defense – State of Israel. Total grant: \$72,000. Period: September 2005.
- Prof. Elon Rimon and Dr. Amir Shapiro, "*An Autonomous Climbing Device for Counter-Terrorism Duty*". Source: the Asher Peled Foundation, Technion. Total grant: \$5,000. Period: May 2004 – May 2006.

## PATENTS

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- Shraga Shoval and Amir Shapiro, "*Dual Tracked Mobile Robot for Motion in Rough Terrain*". PCT submitted November 2006
- Amir Shapiro, "*A Pneumatically Driven Mule-Like Quadruped Autonomous Robot*". Provisional submitted January 2007

## LIST OF PUBLICATIONS

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### Ph.D. THESIS

*Design and Control of an Autonomous Spider-Like Robot for Motion in 2D Tunnels Environments*, Technion, Israel, September 2003.

### M.Sc. THESIS

*Design and Control of a Planar Spider Robot*, Technion, Israel, October 1999.

## JOURNAL PUBLICATIONS

1. E. Rimon, S. Shoval and A. Shapiro, "Design of a Quadruped Robot for Motion with Quasistatic Force Constraints", Journal of Autonomous Robots, Volume 10 May 2001, pp. 279-296.
2. A. Shapiro, E. Rimon, S. Shoval, "Immobilization Based Control of Spider Robots in Tunnels Environment", The International Journal of Robotics Research, Volume 20 Number 3 March 2001, pp.209-227.
3. A. Shapiro, "The Future is Here – Making Walking Machines: Planar Spider Robot", Machines & Industry Magazine published by Medium - Professional Magazines Network, Volume 92, May 2004, pp. 39-41,88.
4. A. Shapiro, "Stability of second-Order Asymmetric Linear Systems With Application to Robot Grasping", ASME Journal of Applied Mechanics, Volume 72 (6),November 2005, pp. 966-968.
5. A. Shapiro, E. Rimon, S. Shoval, "PCG: A Foothold Selection Algorithm for Spider Robot Locomotion in 2D Tunnels", International Journal of Robotics Research, Vol. 24 (10) , November 2005 pp. 823-844.
6. Amir Shapiro, Shraga Shoval, "Design and Locomotion of a Semi-passive Mobile Platform", Springer Tracts in Advanced Robotics, Volume 25, Jul 2006, Pages 319 - 330, DOI 10.1007/11736592\_27, URL [http://dx.doi.org/10.1007/11736592\\_27](http://dx.doi.org/10.1007/11736592_27)
7. A. Shapiro, E. Rimon, S. Shoval, "Force Closure Set of Linearly Controlled Grasps", in preparation. will be submitted to the International Journal of Robotics Research.
8. A. Shapiro, S. Shoval, "Design and Motion Planning of a Semi-Passive Mobile Platform for Locomotion on Slippery Surfaces", in preparation.

#### CONFERENCE PAPERS

1. A. Shapiro, A. Greenfield, H. Choset, "Frictional Compliance Model Development and Experiments for Snake Robot Climbing", IEEE International Conference on Robotics & Automation, April 2007, Rome Italy.
2. S. Sarid, A. Shapiro, Y. Gabriely, "MRBUG: A Competitive Multi Robot Path Finding Algorithm", IEEE International Conference on Robotics & Automation, April 2007, Rome Italy.
3. S. Sarid, A. Shapiro, and Y. Gabriely, "Online Motion Planning Algorithm for a Group of Robots Obtaining a Common Goal" Israeli Conference of Robotics (ICR), June 2006, Tel Aviv, Israel.
4. S. Shoval, A. Shapiro, A. Novak, S. Papo, "3D Spider Robot for Motion in Congested Environments" Israeli Conference of Robotics (ICR), June 2006, Tel Aviv, Israel.
5. S. Sarid, A. Shapiro, Y. Gabriely, "MRSAM: A Quadratically Competitive Multi-Robot Online Navigation Algorithm", IEEE International Conference on Robotics & Automation, May 2006, Orlando, FL, USA.
6. A. Shapiro and S. Shoval, "Design and Locomotion of Semi-Passive Mobile Platform", The 5th International Conference on Field and Service Robotics, July 29-31 2005, Port Douglas Australia.
7. A. Shapiro, I. Mahpoda and H. Zuk, "A Snail Inspired Wall Climbing Robot for Counter Terrorism Duty", The 30th Israeli Conference on Mechanical Engineering, May 29-30 2005, Tel-Aviv Israel.
8. S. Shoval and A. Shapiro, "A Semi-Passive Mobile Platform for Motion on Slippery Surfaces", The 30th Israeli Conference on Mechanical Engineering, May 29-30 2005, Tel-Aviv Israel.
9. A. Shapiro, E. Rimon, J. W. Burdick, "On the Mechanics of Natural Compliance in Frictional Contacts and its Effect on Grasp Stiffness and Stability", IEEE International Conference on Robotics & Automation, April 2004, New Orleans, LA, USA.

10. A. Shapiro, E. Rimon, S. Shoval, "*Motion Planning for a Planar 3-Legged Robot in Tunnel Environments*", The 13<sup>th</sup> Industrial Engineering and Management Conference, March 2004.
11. A. Shapiro, S. Shoval, M. Zacksenhouse, Y. Halevi, and students, "*Design and Development of a Mobile Robot for the RoboCup Games*", The 29<sup>th</sup> Israel Conference on Mechanical Engineering, May 2003.
12. A. Shapiro, E. Rimon, S. Shoval, "*Computation and Experiments of Passive Force Closure in Compliant-Rigid Grasps*", The 29<sup>th</sup> Israel Conf. on Mech. Eng., May 2003.
13. A. Shapiro and E. Rimon, "*PCG: A Foothold Selection Algorithm for Spider Robot Locomotion in 2D Tunnels*", IEEE International Conference on Robotics & Automation, September 2003, Taipei, Taiwan.
14. A. Shapiro, E. Rimon, J. W. Burdick, "*Passive Force Closure and its Computation in Compliant-Rigid Grasps*", IEEE/RSJ International Conference on Intelligent Robots and Systems, November 2001 Maui, Hawaii, USA.
15. A. Shapiro, E. Rimon, S. Shoval, "*Immobilization Based Control of Spider Robots in Tunnel Environments*", The IEEE International Conference on Robotics & Automation, May 2001, Seoul Korea.
16. A. Shapiro, E. Rimon, S. Shoval, "*Design of a Spider Robot for Motion with Quasistatic Force Constraints*", The 28<sup>th</sup> Israel Conf. on Mech. Eng., July 2000.
17. A. Shapiro, E. Rimon, S. Shoval, "*Immobilization Based Control of Spider Robots in Tunnels Environment*", The 21<sup>st</sup> IEEE Convention of Electrical and Electronic Engineers in Israel, May 2000.
18. E. Rimon, S. Shoval, A. Shapiro, "*Design of a Spider Robot Based on Second-Order Immobilization Theory*", The 9<sup>th</sup> International Symposium on Robotics Research, pp15-22, J. Hollerbach and D. Koditschek Editors, Springer Verlag, 1999.
19. S. Shoval, E. Rimon, A. Shapiro, "*Design of a Spider-Like Robot for Motion with Quasistatic Force Constraints*", The IEEE International Conference on Robotics & Automation, May 1999, Detroit USA. .

#### **SPECIAL PRESENTATIONS**

1. A. Shapiro, "*Design and Control of an Autonomous Spider-Like Robot for Motion in 2D Tunnel Environments*", November 15<sup>th</sup> 2005, invited CFR seminar at the Robotics Institute at Carnegie Mellon University, Pittsburgh, PA , USA.
2. A. Shapiro, "*Motion Planning, Control, and special Structures of Mobile Robots*", October 29<sup>th</sup> 2004, An invited lecture to high school students in the opening ceremony of the special university program to promote accessibility of students to higher education.
3. A. Shapiro, "*Planar Spider Robots – A Step Towards Walking Machines*", March 10<sup>th</sup> 2004, Ph.D. Thesis selected by the dean of graduate students at the Technion for presentation in a special series of lectures by outstanding graduate students.
4. A. Shapiro, "*Design and Control of an Autonomous Spider-Like Robot for Motion in 2D Tunnel Environments*", December 18<sup>th</sup> 2003, A presentation to foreign military attaches at their visit in the Technion.
5. A. Shapiro, "*Design and Control of an Autonomous Spider-Like Robot for Motion in 2D Tunnel Environments*", June 11<sup>th</sup> 2003, invited seminar at the Dept. of Mechanical Engineering, Ben Gurion University of the Negev.

#### **POPULAR SCIENCE / MEDIA COVERAGE**

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1. "Documentary Program on Artificial Intelligent and Robots" Yunsoo Kim, SBS South Korea TV channel, April 5, 2006, <http://www.sbs.co.kr>
2. "*Robotic Snakes* ", Pittsburgh Genius, Pittsburgh Community TV 21, January 18 2006, <http://www.pittsburghgenius.com/>
3. "*Robocup*", Theory of Conspiracy, Israel Galey Tzhahal Radio station, July 26<sup>th</sup> 2005 10:30pm.
4. "*Spider-Robot*", Micro-Scoop, Israel Teva-Hadvarim TV channel, August 24<sup>th</sup> 2004 6:00pm.
5. "*Spider-Robot*", Science news, The Israeli TV science channel, June 30<sup>th</sup> 2004 7:00pm.
6. "*Spider-Robot*", Technion President's Report, June 2004.
7. "*Technion Researchers Developed Spider Robot for Motion in Tunnels Environments*", HaTechnion – The Technion Magazine, June 2004.
8. "*Spider-Robot*", National Geographic Magazine, Hebrew edition, June 2004.
9. "*Spider-robot to the Rescue*", Technion Focus, May 2004.
10. "*Autonomous Techno-Dance*", Technion Focus, May 2004.
11. "*Spider-Robot*", Alex Doron, Maariv newspaper. April 4<sup>th</sup> 2004.
12. "*Technion Researchers Develop Spider Robot*", Press Release by the Technion's Spokesperson, March 14<sup>th</sup> 2004.
13. "*The Spider-Robot and the Iranian Team (Robocup)*" Gal Mor, Yedioth Aharonot newspaper, April 7<sup>th</sup> 2002.
14. "*Robotic Soccer*", HaTechnion – The Technion Magazine, March 2002.
15. "*The Spider-Robot*", HaTechnion – The Technion Magazine, June 2002.
16. "*RoboCup*", Mabat - Israel Channel 1 TV News, May 4<sup>th</sup> 2002.