

August 2018

CURRICULUM VITAE

ZVI S. ROTH

1. PERSONAL INFORMATION

1. Name and Title

Zvi Shimshon Roth
Professor of Electrical Engineering

2. Address

Computer & Electrical Engineering & Computer Science (CEECS) Department
Engineering East Building Room 519
Florida Atlantic University
777 Glades Road
Boca Raton, Florida 33431

3. Telephone:

Office: (561) 297-3471
FAX: (561) 297-2800
E-mail: rothz@fau.edu

4. Citizenship

U. S. citizen (since June 1991)
Israeli citizen

Personal Web Page: <https://faculty.eng.fau.edu/rothz/>

Bio Sketch: Dr. Roth received his BSc and MSc in Electrical Engineering from the Technion, Israel Institute of Technology in 1975 and 1979, and his PhD in Systems Engineering from Case Western Reserve University (1983). He is presently a Professor of Electrical Engineering at the Department of Computer and Electrical Engineering and Computer Science at Florida Atlantic University in Boca Raton Florida. His teaching and research interests are in Control Systems, Robotics and Automation, Electronic Circuit Design and Bioengineering. He co-authored two books in Robotics and one in Control Systems, and over 70 refereed publications. He served as Director of the FAU Robotics Center (1985-1994), Chair of the FAU EE Department (1993-1997), Director of the Florida-Israel Institute (2005-2008) and Associate Chair of the FAU CEECS Department (2009-2013). Dr. Roth is the winner of multiple FAU teaching awards.

II. PROFESSIONAL INFORMATION

1. Educational Background

1.1. Academic Degrees

Ph.D. in Systems Engineering, Case Western Reserve University, Cleveland, Ohio, December 1982. (Degree formally awarded in 1983).

M.Sc. in Electrical Engineering, Technion, Israel Institute of Technology, Haifa, Israel, July 1979.

B.Sc. in Electrical Engineering, Technion, Israel Institute of Technology, Haifa, Israel, September 1974.

1.2. Professional Development Activities

1/85 - 12/85 Visiting Consultant
Process Automation Group, Manufacturing Systems Products
IBM Corporation, Boca Raton, Florida

10/12 – 7/13 Sabbatical Leave: Visiting Professor at the Technion Israel
Institute of Technology, Department of Electrical Engineering
(October 2012-July 2013).

2. Employment History

9/93-9/09 & Professor
10/13-present Department of Electrical Engineering
Florida Atlantic University

7/13-10/13 Professor and Interim Chairman
Department of Computer & Electrical Engineering & Computer
Science

10/12-7/13 Visiting Professor
Department of Electrical Engineering
Technion, Israel Institute of Technology

9/09-7/13 Professor and Associate Chairman
Department of Computer & Electrical Engineering & Computer
Science

9/05-10/08 Interim co-Director
Florida-Israel Institute
Florida Atlantic University

8/94-12/97 Chairman
Department of Electrical Engineering
Florida Atlantic University

8/93-7/94 Acting Chairman, Department of Electrical Engineering
Florida Atlantic University
Elected as Chairman 2/17/94

9/85 -7/94 Director of the Florida Atlantic University Robotics Center

6/87 - 9/93 Associate Professor
Department of Electrical Engineering
Florida Atlantic University (Tenured since May 1987)

9/84-8/85 Associate Director of the Florida Atlantic University Robotics
Center

8/83 -6/87 Assistant Professor
Department of Electrical and Computer Engineering
Florida Atlantic University

9/82-7/83 Visiting Assistant Professor
Department of Electrical and Computer Engineering
Florida Atlantic University

9/80 - 9/82 Research Assistant
Case Western Reserve University
Department of Systems Engineering

9/74 - 9/75 Electronics Engineer
RADA, Inc., Haifa, Israel

3. Instructional Experience

3.1. Courses recently developed or modernized: Undergraduate level: Fundamentals of Engineering (hands-on freshmen-level course), Electronics I and II (with PSPICE computer-aided analysis and design), Control Systems I (with Matlab / Simulink system design), Introduction to DSP (with Matlab). Graduate level: CMOS Amplifiers (with PSPICE and ADS design), Biosystems Modeling and Control (with Matlab / Simulink simulations), Control Systems 2 (with Matlab / Simulink), Modern Control (with Matlab/Simulink).

3.2. Full List of Courses Taught at FAU (***) indicates a course that was taught in recent years)

EGN 1002 Fundamentals of Engineering (7 times) ***

EEN 3935	Electronic Design with Operational Amplifiers (7 times)
EEL 1007C	Electronic Design with Operational Amplifiers (4 times) ***
EEL 3003	Analog Electronics for Non EE Majors (1 time)
EEL 3130	Network Analysis I (3 times)
EEL 3111	Network Analysis I (3 times)
EEL 3300	Electronics I (20 times as regular class, 3 times Mostly Online) ***
EEL 4361	Electronics II (22 times as regular class, 2 times as Mostly Online) ***
EEL 4510	Introduction to DSP (4 times) ***
EEL 4512	Communication Systems (1 time)
EEL 4541	Probability and Random Processes (4 times)
EEL 4652	Control Systems I (12 times) ***
EEL 4652L	Control Lab (1 time)
EEL 4656	Linear System Analysis (2 times)
EEL 4914	Senior Project I (1 time)
EEL 4915	Senior Project II (3 times)
EEL 4933	Advanced Control Design (1 time)
EEL 5500	Digital Communication Systems (1 time)
EEL 5613	Modern Control (3 times)***
EEL 5653	Digital Control (8 times)
EEL 5654	Control Systems II (9 times) ***
EEL 5321	CMOS Amplifiers (4 times regular, 1 time Mostly Online) ***
BME 5742	Bio-Systems Modeling and Control (11 times as regular class, 1 time as Mostly Online) ***
EEL 6624	Nonlinear Systems (6 times)
EEL 6665	Robot Manipulators (3 times)
EEL 6935	Robot Calibration (1 time)

3.3. Completed Ph.D. Dissertations Supervised

1. Tuula Ruokonen, "Nonlinear Filtering Techniques for Failure Detection in Dynamic Systems", August 1989.
2. Hanqi Zhuang, "Kinematic Modeling, Identification and Compensation of Robot Manipulators", November 1989. Co-advisor with Dr. Fumio Hamano.
3. Hua Xu, "Derivation and Identification of Linearly Parametrized Robot Manipulator Dynamic Models", February 1992, Co-advisor with Dr. Ali Zilouchian.
4. Jian Wang, "Workspace Evaluation and Kinematic Calibration of Stewart Platforms" November 1992, Co-advisor with Dr. Oren Masory.
5. Kuanchih Wang, "Synthesis of Vision-Based Robot Calibration Using Moving Cameras", June 1993, Co-advisor with Dr. Hanqi Zhuang.
6. Shui Hu-Motaghedi, "Self calibration of Laser Tracking Measurement System With Planar Constraints", August 1999, Co-advisor with Dr. Hanqi Zhuang.
7. Ying Bai, "Design and Implementation of a Control System for a Laser Tracking Measurement System", May 2000, Co-advisor with Dr Hanqi Zhuang.

8. Wilfredo Rivas-Torres, "An Empirical Methodology for Foundry Specific Submicron CMOS Analog Circuit Design", December 2013.
9. Aura Maria Cardona Baquero, "Design Considerations in High-Throughput Automation for Biotechnology Protocols", December 2014.

3.4. M. S. Theses Supervised

1. To Choi Lau, "The Dynamics of the Generalized Manipulator", April 1985.
2. Oussama El-Balah, "Kalman Filtering in Robot Calibration", April 1987.
3. Shoupu Chen, "Robot Calibration Using Stereo Vision", December 1987. Co-advisor with Dr. R. Sudhakar.
4. Hua Xu, "Modeling Errors in Kalman Filters", April 1988
5. Ajey A. Mohile, "Robot Singularities Under Small Perturbation in the Kinematic Parameters", November 1988.
6. Neal J. Alewine, "A Simplified Jacobian Representation of Robot Manipulators", November 1988.
7. Huseyin Hakan Yakali, "Interactive Computer Aided Digital Control Design", November 1988.
10. Xuan Xu, "Camera Calibration Techniques", November 1991. Co-Advisor with Dr. H. Zhuang.
11. Cristian Popescu, "Control of Under Actuated Horizontal Double Pendulum", May 2002. Co-advisor with Dr. Yuan Wang. [M.S. Thesis in Mathematics]
12. Wilfredo Rivas-Torres, "Submicron CAD Design and Analysis of MOS Current Mirrors", April 2004.
13. Meta Leesirikul, "A Study on Glucose Metabolism: Computer Simulation and Modeling", August 2005. Co-advisor with Drs. Sal Morgera and P. Neelakanta.

3.5 Educational Program Development

1. Zvi Roth, Yuandan Lin and Yuan Wang, "Accelerated Joint MS in Mathematics and Ph.D in Electrical Engineering Graduate Degree Program", Proposal submitted in Fall 2000, approved by the FAU Mathematics and Electrical Engineering Departments, by the FAU College of Science and College of Engineering Graduate Studies Committees, and by the FAU Graduate Studies Committee (Spring 2001).
2. Salvatore Morgera and Zvi Roth, "M.S. Degree in Bioengineering", Proposal, 2005-2006 – Program in place (effective Spring Semester 2007).
3. Salvatore Morgera and Zvi Roth, "Ph.D. Degree in Bioengineering", Proposal (draft), 2005.
4. Zvi Roth, "M.S. Degree in Bioengineering – Revised Curriculum", Draft Proposal, Spring 2015.
5. Javad Hashemi and Zvi Roth, "Market-Based M.S Degree in Bioengineering", Proposal, Spring 2015.
6. Oren Masory, Daniel Meeroff, Mirjana Pavlovic and Zvi Roth, "Curriculum planning for a BS degree program in Bioengineering", Fall 2016 and Spring 2017.

7. Oren Masory, Daniel Meeroff, Mirjana Pavlovic and Zvi Roth, “New Academic Degree Program Authorization Pre-Proposal Form: BS degree program in Bioengineering”, Spring 2017 and Summer 2017.

3.6. Other Instructional Activities at FAU

- * Development of the Electrical Engineering Control Laboratory (1984-1985) and the EEL 4652L - Control Systems Lab course.
- * Experiment Manuals written: DC-Servo, Analog Computer, Temperature Process Control
- * Development and academic supervision of the EEL 5660L - Robotics Lab course (1986-1990)
- * Development of the Florida Engineering Scholar Program (ESP) course “Electronic Design with Operational Amplifiers” (Roger Messenger and Zvi Roth), Spring 1998 (course for gifted high school students).
- * Development of the EGN 1002 “Fundamentals of Engineering” course (Zvi Roth, Daniel Raviv and T.C. Su), 1998. Course has been offered 1998-Present.
- * Revision of the EEL 1007C “Electronic Design with Operational Amplifiers” (Zvi Roth and Ali Zilouchian) – course has been offered every summer to gifted high-school students, 1999-2017.
- Development of PSPICE Tutorials for several courses: EEE 3111 Circuits 1, EEE 3300 Electronics 1, EEE 4361 Electronics 2, EGN1002 Fundamentals of Engineering and EEL 1007 Electronic Design with Operational Amplifiers.
- Developed and taught a full-internet version of the EEE 3300 Electronics 1 course on a Blackboard platform

3.7. Instructional Activities at other Institutions

1. October 2012 – February 2013: Technion 044142 Linear Electronic Circuits
2. March 2013 – July 2013: Technion 044004 CAD of Analog Electronic Circuits, and 046006 Biosystems Modeling and Control
3. 9/79 - 9/80 Teaching Assistant
Case Western Reserve University
Department of Systems Engineering
Control Laboratory course
4. 9/75 - 9/79 Teaching Assistant
Technion, Israel Institute of Technology
Department of Electrical Engineering

Problem Session Instruction in the courses:

Electronics II, Linear Systems II, Control Systems, Nonlinear Systems, Control Instrumentation.

Lab Instruction in the courses: Electronics Lab II, Control Lab (Control Lab Supervisor, 1978-1979).

3.8. Teaching Awards

- 1977 Second Place (out of 50) Best Teaching Assistant Award, Department of Electrical Engineering Students Organization, The Technion, Israel Institute of Technology.
- 1978 First Place (out of 50) Best Teaching Assistant Award, Department of Electrical Engineering Students Organization, The Technion, Israel Institute of Technology.
- 1979 First/Second Place (out of 50) Student's Best Teaching Assistant Award Department of Electrical Engineering, The Technion, Israel Institute of Technology.
- 2002 Winner of the 2001-2002 Florida Atlantic University Undergraduate Teaching Award.
- 2006 Finalist, 2005-2006 FAU Distinguished Teacher of the Year Award
- 2012 Finalist, 2011-2012 FAU Distinguished Teacher of the Year Award
- 2017 Finalist, 2017 FAU Distinguished Teacher of the Year Award

4. Scholarly Achievements

4.1. Research Interests (***) indicates a recent research area)

- a) Kinematic Modeling, Metrology (Vision and Laser Tracking), Kinematic Identification, Control and Calibration of Robots and Manufacturing Machinery.
- b) Control Systems – Auto-Tuned PID Control, Lyapunov-type Nonlinear Control, Sliding-Mode Control, Kalman Filters and Nonlinear Filters in Fault Detection and Diagnosis.
- c) Analog Electronic Circuits Design – Computer-Aided Design of CMOS Analog Circuits, Testing of 3D Integrated Circuits (***)
- d) Bio-Systems Modeling and Control – Glucose Metabolism and Closed-loop Drug Delivery for Diabetes Treatment; Epitope Bioinformatic Characterization and Dynamic System Modeling of the Immune System Towards Rational Vaccine Design (***)
- e) Robotics and Automation for Biotechnology – Automation Integrative Design for High-Throughput High-Yield Systems (***)
- f) Smart Grid Systems – Optimal Power Distribution in Microgrid Communities (***)

4.2. Publications

4.2.1. Refereed Journal Articles

33. F. Ashikin, M. Hashizume, H. Yotsuyanagi, S.K. Lu and Z. Roth, "A Design for Testability of Open Defects at Interconnects in 3D Stacked ICs", *IEICE Transactions on Information & Systems*, Vol. E101-D, No. 8, August 2018, pp. 2053-2063.
32. Widiat, M. Hashizume, S. Suenaga, H. Yotsuyanagi, A. Ono, S.K. Lu and Z. Roth, "A Built-in Test Circuit for Electrical Interconnect Testing of Open Defects in Assembled PCBs", *IEICE Transactions on Information & Systems*, Vol. E99-D, No. 11, November 2016, pp. 2723-2733.
31. Wilfredo Rivas-Torres and Zvi Roth, "Determination and Study of MOSFET Technology Current", *Canadian Journal on Electrical and Electronics Engineering* Vol. 4, No. 2, April 2013.
30. Aura-Maria Cardona, Zvi S. Roth and Chingping Han, "High-Throughput Automation Design Considerations for Biotechnology Processes Involving RNA Purification Protocols using Multi-Centrifuge Bioseparation Steps", *Journal of Robotics and Computer-Integrated-Manufacturing*, Volume 28, Issue 3, June 2012, pp 285-293.
29. Banton, S.A., Roth, Z., Pavlovic, M. *A bioengineering approach for rational vaccine design towards the Ebola Virus. BMC Bioinformatics*, Special Issue: ISMB (Intelligent Systems for Molecular Biology) 2010, July 8-11, 2010, Boston, Massachusetts
28. Perambur S. Neelakanta, Meta Leesirikul, Zvi Roth and Salvatore Morgera, "A Complex System Model of Glucose Regulatory Metabolism", *Complex Systems*, 16 (2006) 343-367.
27. David C. Sheats, Zvi S. Roth and Joseph W. Snyder, "Autotune of PID Temperature Control Based on Closed-Loop Step Response Tests", *Proceedings of CEC Advances in Cryogenic Engineering*, 2006 (regular journal paper).
26. Ying Bai, Zvi S. Roth and Hanqi Zhuang, "Fuzzy Logic Control to Suppress Noises and Coupling Effects in a Laser Tracking System", *IEEE Transactions on Control Systems Technology*, Vol. 13, No. 1, January 2005, pp. 113-121.
25. Hanqi Zhuang, Shui H. Motaghedi, Zvi S. Roth and Ying Bai, "Calibration of Multi-Beam Laser Tracking Systems", *Robotics and Computer-Integrated Manufacturing* 19 (2003), pp 301-314.

24. H. Zhuang, W. C. Wu and Z. S. Roth, "Camera-Assisted Robot Calibration for SCARA Arms", IEEE Robotics and Automation Magazine, Vol. 3, No. 4, 1996, pp. 46-53.
23. H. Zhuang, and Z. S. Roth, "A Note on 'Singularity Studies Using a Modified CPC Model'", Journal Robotics and CIM, Vol 12, No. 2, 1996, pp. 169-171.
22. H. Zhuang and Z. S. Roth, "A Tutorial on Robot Calibration with Hand-mounted Cameras," International Journal of Intelligent Automation and Soft Computing, Vol. 1, No. 3, 1995, pp. 325-344.
21. H. Zhuang and Z. S. Roth, "A Note on 'A Linear Solution to the Kinematic Parameter Identification of Robot Manipulators'", IEEE Transactions on Robotics and Automation, Vol 11. No. 11, 1995, pp. 922.
20. H. Zhuang and Z. S. Roth, "Modeling Gimbal Axis Misalignments and Mirror Center Offset in a Single-beam Laser Tracking Measurement Systems", The International Journal of Robotics Research, Vol. 14, No. 3, June 1995, pp. 211-224.
Also in:
Proceedings of the IEEE International Conference on Robotics and Automation, San Diego, CA, May 1994, pp. 3416-3421.
19. H. Zhuang, L. Wang and Z. S. Roth, "Simultaneous Calibration of a Robot and a Hand-mounted Monocular Camera", IEEE Transactions on Robotics and Automation, Vol. 11, No. 5, 1995, pp. 649-660.
A version of this paper also appeared as:
H. Zhuang, L. Wang, and Z. S. Roth, "Simultaneous Calibration of a Robot and a Hand-mounted Camera", Proceedings IEEE International Conference on Robotics and Automation, Atlanta, GA, Vol. 2, pp. 149-154, May 1993,
18. H. Zhuang, Z. S. Roth and R. Sudhakar, "Simultaneous Calibration of Robot/World and Hand/Eye Transformation by Solving System of Equations of the Form $AX=YB$ ", IEEE Transactions on Robotics and Automation, Vol. 10, No. 4, August 1994, pp. 549-554.
A version of this paper also appeared as
Z. S. Roth, H. Zhuang and R. Sudhakar, "Simultaneous Calibration of Robot/World and Eye/Hand Transformations", Proceedings of IROS'92, 1992 IEEE/RSJ International Conference on Intelligent Robots and Systems, July 1992, Raleigh, North Carolina, 1063-1070.
17. H. Zhuang, Z. S. Roth and K. Wang, "Robot Calibration by Mobile Camera Systems", Journal of Robotic Systems, Vol. 11, No. 3, 1994, pp. 155-168.
Also in:
Advances in Instrumentation-1991, DSC-Vol. 30, pp. 65-72, ASME Winter Annual Meeting, Atlanta, Georgia, December 1991

16. H. Zhuang, Zvi S. Roth, Xuan Xu and K. Wang, "Camera Calibration issues in Robot Calibration with Eye-on-Hand Configuration", Accepted as regular paper to Journal of Robotics and Computer Integrated Manufacturing Special issue: "Intelligence in Robotics and Manufacturing", Vol. 10, No. 6, pp. 401-412, 1993.
A version of this paper also appeared as
H. Zhuang, Z. S. Roth, X. Xu and K. Wang, "A Simplified RAC-based Camera Calibration Algorithm and Related Implementation Issues," ASME Press Series, "Robotics and Manufacturing--Recent Trends in Research, Education and Applications" Vol. 4, Proceedings 4th International Symposium on Robotics and Manufacturing (ISRAM'92), November 1992, Santa Fe, NM, pp. 97-102.
15. H. Zhuang, Z. S. Roth and F. Hamano, "Optimal Design of Robot Accuracy Compensators", IEEE Transactions on Robotics and Automation, December 1993, Vol. 9, No. 6, pp. 854-857.
Earlier Versions appeared as:
H. Zhuang, F. Hamano and Z. S. Roth, "Optimal Design of Robot Accuracy Compensators", Proceedings of 1989 IEEE International Conference on Robotics and Automation, Scottsdale, Arizona, pp. 751-756, May 1989.
H. Zhuang, F. Hamano and Z. S. Roth, "Optimal Solution to the Neighboring Inverse Kinematics", Proceedings of 1988 IEEE Conference on Decision and Control, Austin, Texas, December 1988, pp. 2284-2285.
14. H. Zhuang, K. Wang and Z. S. Roth, "Error-Model-Based Robot Calibration Using a Modified CPC Model", International Journal of Robotics and Computer-Integrated Manufacturing, Vol 10, No. 4, 1993, pp. 287-299.
Appeared earlier as:
H. Zhuang, Z. S. Roth and K. Wang, "Robot Calibration Using a Modified Denavit Hartenberg Model", ASME Press Series, "Robotics and Manufacturing--Recent Trends in Research, Education and Applications", Vol. 4, Proceedings of the Fourth International Symposium on Robotics and Manufacturing (ISRAM'92), November 1992, Santa Fe, NM, pp. 33-36.
And in:
Proceedings of the 5th Annual Conference on Recent Advances in Robotics, Florida Atlantic University, June 11-12, 1992, pp. 602-629.
13. H. Zhuang and Z. S. Roth, "A Linear Solution to the Kinematic Parameter Identification of Robot Manipulators", IEEE Transactions on Robotics and Automation, Vol. 9, No. 2, pp. 174-185, April 1993.
A version of this paper also appeared as:
"A Closed Form Solution to the Kinematic Parameter Identification of Robot Manipulators", Proceedings IEEE Robotics and Automation Conference, Sacramento, California, pp. 2682-2689, April 1991.
12. H. Zhuang and Z. S. Roth, "Method for Kinematic Calibration of Stewart Platforms", Journal of Robotic Systems, 10(3), pp. 391-405, April 1993.

Also in:

Applications of Modeling and Identification to improve Machine Performance, DSC-Vol. 29, pp. 43-48, ASME Winter Annual Meeting, Atlanta, Georgia, December 1991 and Proceedings of the 4th Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton, Florida, pp. 156-168, May 1991.

11. H. Zhuang, Z. S. Roth and R. Sudhakar, "Fusion Algorithms for Rotation Matrices", Journal of Robotic Systems, Vol. 9(7), October 1992, 915-932.
Shorter versions of this paper appeared in: "Practical Fusion Algorithms for Rotation Matrices", 1991 American Control Conference, Boston, Massachusetts, pp. 2064-2065, June 1991. (Short paper)
"Practical Fusion Algorithms for Rotation Matrices", Proceedings 4th Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton Florida, pp. 330-346, May 1991.
- 10 H. Zhuang, B. Li, Z. S. Roth and X. Xie, "Self Calibration and Mirror Offset Elimination of a Multi-Beam Laser Tracking System", International Journal of Robotic and Autonomous Systems. Special issue on "Trends in Robot Kinematics, Dynamics, Control, Sensing and Computer Programming", Vol. 9, 1992, 255-269.
Also in:
H. Zhuang, B. Li, Z. S. Roth and F. Hamano, "Self-Calibration of a Laser Tracking Coordinate Measuring Machine", Robotics and Manufacturing, Recent Trends in Research, Education and Applications, Vol. 3, edited by M. Jamshidi and M. Saif, pp. 197-203, 1990. (Also presented at ISRAM'90, Third International Symposium in Robotics and Manufacturing, July 1990).
and
"Calibration of a 3-D Laser Measurement System", Proceedings of PROCIEEM'89-The Second Conference on Productivity Through Computer Integrated Engineering and Manufacturing, Orlando, Florida, November 1989.
9. H. Zhuang and Z. S. Roth, "Robot Calibration Using the CPC Error Model", International Journal of Robotics and Computer-integrated Manufacturing, Vol. 9, No. 3, September 1992, 227-237.
A version of this paper appeared as a Book Chapter -- See 4.2.3., 11. September(3).
8. H. Zhuang, Z. S. Roth and F. Hamano, "A Complete and Parametrically Continuous Kinematic Model for Robot Manipulators", IEEE Transactions on Robotics and Automation, Vol. 8, No. 4, August 1992, 451-463.
A shorter version appeared in: Proceedings of 1990 IEEE International Conference on Robotics and Automation, Cincinnati, OH, pp. 92-98.
7. H. Zhuang, Z. S. Roth and F. Hamano, "Observability Issues in Kinematic Identification of Manipulators", ASME Journal of Dynamic Systems, Measurement and Control, Vol. 114, June 1992, 319-322.

For a longer version of this paper see 4.2.2.(7).

6. H. Zhuang and Z. S. Roth, "Comment on 'Calibration of Wrist-mounted Robotic Sensors by Solving Homogeneous Transform Equations of the Form $AX = XB$ '", IEEE Transactions in Robotics and Automation Vol. 7, No. 6, December 1991, 877-878.

Also refer to:

H. Zhuang and Z. S. Roth, "Authors Reply to Comments on 'Comment on' Calibration of Wrist-mounted Robotic Sensors by Solving Homogeneous Transform Equations of the Form $AX=XB$ '", IEEE Transactions on Robotics and Automation, Vol. 8, No. 4, August 1992,493-494.

5. Z. S. Roth, B. W. Mooring and B. Ravani, "An Overview of Robot Calibration", IEEE Journal of Robotics and Automation, Vol. RA-3, No. 5, October 1987, 377-385.
4. K. A. Loparo, Z. Roth and S. J. Eckert, "Nonlinear Filtering for Systems with Random Structure", IEEE Transactions on Automatic Control, Vol. AC-31, No. 11, November 1986, 1064-1068.
3. Z. S. Roth and K. A. Loparo, "Nonlinear Filtering Problems with Finite Dimensional Matrix Estimation Algebras", Systems and Control Letters, Vol. 7, September 1986,423-427. (Also appeared in the Proceedings IEEE Conference on Decision and Control, Fort Lauderdale, Florida, December 1985, pp. 1953-1956.
2. S. J. Eckert, K. A. Loparo and Z. S. Roth, "An Application of Nonlinear Filtering to Instrument Failure Detection in a Pressurized Water Reactor", Nuclear Technology, Vol. 74, August 1986, 139-151.
1. Z. S. Roth and K. A. Loparo, "Optimal Filter Realization for a Class of Nonlinear Systems with Finite Dimensional Estimation Algebra", Systems and Control Letters, 4, February 1984, 23-26.

4.2.2. Refereed Conference Proceedings

41. H. Zhuang, Z. Roth, O. Masory and N. Erdol, "Assistive Technology in Capstone Engineering Design", IEEE IS3C, X'ian China, July 2016.
40. T. Miabe, M. Hashizume, H. Yotsuyanagi, S.K. Lu and Z. Roth, "A Built-in Test Circuit for Detecting Open Leads in Assembled PCB Circuits", ICEP 2016 Proceedings, FC3-1, pp. 451-455.
39. Shoichi Umezu, Masaki Hashizume, Hiroyuki Yotsuyangi, Shyue-Kung Lu and Zvi Roth, "Feasibility of Interconnect Tests of Open Defects in a 3D-IC with Built-In Supply Current test Circuit", Digest of Papers of the 14th IEEE Workshop on RTL and High Level Testing (WRTL 2013), pp. I.1.F-1 – I.1.F-5, Yilan, Taiwan, November 2013.

38. Widiyanto, Hiroyuki Yotsuyanagi, Akira Ono, Masao Takagi, Zvi Roth and Masaki Hashizume, "A Built-in Electrical Test Circuit for Interconnect tests in Assembled PCBs," Proc. of IEEE CPMT Symposium, Kyoto Japan, December 10-12, 2012 (ICSJ 2012), pp.201-204, 2012. ISBN#: 978-1-4673-2653-7, IEEE Catalog Number: CFP12PWJ-PRT
37. M.Hashizume, S.Kondo, E.Haraguchi, H.Yotsuyanagi, T.Tada and Z. Roth: "Output Voltage Estimation Method of Hard Open TSV in 3D ICs," Digest of Papers of the 13th IEEE Workshop on RTL and High Level Testing, November 22-23, 2012, Niigata, Japan, pp.6.1.1-6.1.5, 2012.
36. Banton, S.A., Roth, Z. *Mathematical Modeling of Ebola Virus Dynamics as a Step towards Rational Vaccine Design*. IFMBE Proceedings 26th Southern Biomedical Engineering Conference 2010, 30 April - 2 May 2010, College Park, Maryland, Springer, 2010
35. Zhuang H., S. Hu and Z. Roth, "Observability of Error Parameters of Laser Tracking Systems Under Plane Constraints", Proceedings of the IEEE International Conference on Robotics and Automation, May 1999, Detroit MI, pp 805-810.
34. Y. Bai, Z. S. Roth and H. Zhuang, "Design and Implementation of a Fuzzy Logic Controller for a Laser Tracking CMM", Proceedings of FUZZY'97, International Conference on Fuzzy Logic and Applications, Zichron Yaakov, Israel, May 18-21, 1997, pp. 385-390.
33. H. Zhuang, R. Sudhakar and Z. S. Roth, "A New Method for Pose Fitting from Two 3D Point Sets and Its Application to Robot Localization", Proceedings of IEEE International Conference on Robotics and Automation, Minneapolis, MN, April 1996, pp. 655-660.
32. H. Zhuang, W. Wu and Z. S. Roth, "Camera-Assisted SCARA Arm Calibration", Proceedings of IEEE/RSJ IROS, 1995, Vol. I, pp. 507-512.
31. H. Zhuang and Z. S. Roth, "A Tutorial on Robot Calibration with Hand-mounted Cameras," Proceedings of ISRAM'94, Maui, HI, August 1994. In *Robotics and Manufacturing*, Vol. 5, ed: M. Jamshidi, C. Nguyen, R. Lumia and J. Yuh, pp. 743-749.
30. H. Zhuang and Z. S. Roth, "Modeling Gimbal Axis Misalignments and Mirror Center Offset in a Single-beam Laser Tracking Measurement Systems", Proceedings of the IEEE International Conference on Robotics and Automation, San Diego, CA, May 1994, pp. 3416-3421.

29. H. Zhuang, L. Wang, and Z. S. Roth, "Simultaneous Calibration of a Robot and a Hand-mounted Camera", Proceedings IEEE International Conference on Robotics and Automation, Atlanta, GA, Vol. 2, pp. 149-154, May 1993,
28. Z. S. Roth, H. Zhuang and R. Sudhakar, "Simultaneous Calibration of Robot/World and Eye/Hand Transformations", Proceedings of IROS'92, 1992 IEEE/RSJ International Conference on Intelligent Robots and Systems, July 1992, Raleigh, North Carolina, 1063-1070.
27. H. Zhuang, Z. S. Roth and K. Wang, "Robot Calibration by Mobile Camera Systems", Advances in Instrumentation-1991, DSC-Vol. 30, pp. 65-72, ASME Winter Annual Meeting, Atlanta, Georgia, December 1991
26. H. Zhuang, Z. S. Roth, X. Xu and K. Wang, "A Simplified RAC-based Camera Calibration Algorithm and Related Implementation Issues,' ASME Press Series, "Robotics and Manufacturing--Recent Trends in Research, Education and Applications' Vol. 4, Proceedings 4th International Symposium on Robotics and Manufacturing (ISRAM'92), November 1992, Santa Fe, NM, pp. 97-102.
25. H. Zhuang, F. Hamano and Z. S. Roth, "Optimal Design of Robot Accuracy Compensators", Proceedings of 1989 IEEE International Conference on Robotics and Automation, Scottsdale, Arizona, pp. 751-756, May 1989.
24. H. Zhuang, F. Hamano and Z. S. Roth, "Optimal Solution to the Neighboring Inverse Kinematics", Proceedings of 1988 IEEE Conference on Decision and Control, Austin, Texas, December 1988, pp. 2284-2285.
23. H. Zhuang, Z. S. Roth and K. Wang, "Robot Calibration Using a Modified Denavit Hartenberg Model", ASME Press Series, "Robotics and Manufacturing--Recent Trends in Research, Education and Applications", Vol. 4, Proceedings of the Fourth International Symposium on Robotics and Manufacturing (ISRAM'92), November 1992, Santa Fe, NM, pp. 33-36.
22. H. Zhuang and Z. S. Roth, "A Closed Form Solution to the Kinematic Parameter Identification of Robot Manipulators", Proceedings IEEE Robotics and Automation Conference, Sacramento, California, pp. 2682-2689, April 1991.
21. H. Zhuang and Z. S. Roth, "Method for Kinematic Calibration of Stewart Platforms", Applications of Modeling and Identification to improve Machine Performance, DSC-Vol. 29, pp. 43-48, ASME Winter Annual Meeting, Atlanta, Georgia, December 1991.
20. H. Zhuang, Z. S. Roth and R. Sudhakar, "Practical Fusion Algorithms for Rotation Matrices", 1991 American Control Conference, Boston, Massachusetts, pp. 2064-2065, June 1991. (Short paper)

19. H. Zhuang, B. Li, Z. S. Roth and F. Hamano, "Self-Calibration of a Laser Tracking Coordinate Measuring Machine", *Robotics and Manufacturing, Recent Trends in Research, Education and Applications*, Vol. 3, edited by M. Jamshidi and M. Saif, pp. 197-203, 1990.
18. H. Zhuang, B. Li, Z. S. Roth and F. Hamano, "Self-Calibration of a Laser Tracking Coordinate Measuring Machine", *ISRAM'90, Third International Symposium in Robotics and Manufacturing*, July 1990.
17. H. Zhuang, B. Li, Z.S. Roth and F. Hamano, "Calibration of a 3-D Laser Measurement System", *Proceedings of PROCIEM'89-The Second Conference on Productivity Through Computer Integrated Engineering and Manufacturing*, Orlando, Florida, November 1989.
16. H. Zhuang and Z. S. Roth, "Robot Calibration Using the CPC Error Model", *International Journal of Robotics and Computer-integrated Manufacturing*, Vol. 9, No. 3, September 1992,227-237.
15. H. Zhuang, Z. S. Roth and F. Hamano, "A Complete and Parametrically Continuous Kinematic Model for Robot Manipulators", *Proceedings of 1990 IEEE International Conference on Robotics and Automation*, Cincinnati, OH, pp. 92-98.
14. H. Zhuang, Z. S. Roth and F. Hamano, "Observability Issues in Kinematic Identification of Manipulators", *ASME Journal of Dynamic Systems, Measurement and Control*, Vol. 114, June 1992, 319-322.
13. Z. S. Roth, B. W. Mooring and B. Ravani, "Robot Precision and Calibration Issues in Electronic Assembly", *Southcon/86*, Orlando, Florida, March 1986.
12. H. Zhuang and Z. S. Roth, "Differential Relationships in the Modeling and Control of a Single-Beam Tracking Measurement System", Presented at *ISRAM'94*, Maui, HI, August 1994.
11. H. Zhuang, K. Wang and Z. S. Roth, "Optimal Selection of Measurement Configurations for Robot Calibration Using Simulated Annealing", *Proceedings of the IEEE International Conference on Robotics and Automation*, San Diego, CA, May 1994.
10. H. Zhuang, K. Wang and Z. S. Roth, "Implementation Issues of Simultaneous Calibration of a Robot and a Hand-mounted Camera", *Proceedings Sixth Annual Conference on Recent Advances in Robotics*, pp- 1B/3:1-1B/3:8, Gainesville, Florida, April 19-20, 1993.

9. H. Zhuang, Z. S. Roth and Z. Qu, "Study of the Jacobian of Single-Beam Laser Tracking Systems", Proceedings Sixth Annual Conference on Recent Advances in Robotics, pp. 2B/2:1-2B/2:7, Gainesville, Florida, April 19-20, 1993.
8. H. Zhuang, Z. S. Roth and F. Hamano, "Observability issues in Kinematic Error Parameters Identification of Manipulators", Proceedings of 1990 American Control Conference, San Diego, California, pp. 2287-2293, May 1990.
7. T. Ruokonen and Z. S. Roth, "Failure Detection Performance Analysis of the Optimal Nonlinear Filter for the Identification Problem", Proceedings of 1989 American Control Conference, Pittsburgh, Pennsylvania, June 1989. (Short paper)
6. Z. S. Roth and Hua Xu, "Effects of Modeling Errors on the Stability and Innovations Moments of Kalman Filters", Proceedings of ICCON'89--IEEE International Conference on Control and Applications, Jerusalem, Israel, April 1989. (Short paper)
5. T. C. Lau and Z. S. Roth, "The Dynamics of Robot Manipulators With Wheeled Base", Proceedings of the Fourth International Symposium on Robotics and Artificial Intelligence in Building Construction, Haifa, Israel, June, 1987, Vol. 1, 379-401.
4. Z. S. Roth and K. A. Loparo, "Nonlinear Filtering Problems with Finite Dimensional Matrix Estimation Algebras", Proceedings IEEE Conference on Decision and Control, Fort Lauderdale, Florida, December 1985, pp. 1953-1956.
3. K. A. Loparo and Z. S. Roth, "On the Solution of the Zakai Equation for the Process Diagnostics Problem", Proceedings IEEE Conference on Decision and Control, Las Vegas, Nevada, December 1984. (Short paper)
2. K. A. Loparo and Z. S. Roth, "Suboptimal Nonlinear Filters for Systems with Random Structure", Proc. IEEE Conference on Decision and Control, San Diego, December 1981.
1. K. A. Loparo and Z. S. Roth, "Nonlinear Filtering for Process Diagnostics", Proc. JACC, University of Virginia, June 1981.

4.2.2. Papers Submitted to Journals

1. N/A

4.2.3. I. Books

2. H. Zhuang and Z. S. Roth, "Camera-Aided Robot Calibration", CRC Press, 1996

1. B. W. Mooring, Z. S. Roth and M. R. Driels, "Fundamentals of Manipulator Calibration", John Wiley and Sons. 1991.

II. Invited Book Chapters

5. Section 8.7 of the book: "*Three-Dimensional Integration of Semiconductors – Processing, Materials and Applications*" Kondo Kazuo, Kada Morihiko and Takahashi Kenji, Editors, Springer 2015, ISBN 978-3-319-18675-7.

Chapter 8: Hiroshi Takahashi, Senling Wang, Shuichi Kameyama, Yoshinobu Higami, Hiroyuki Yotsuyangi, Masaki Hashizume, Shyue-Kung Lu and Zvi Roth, "Trends in 3D Integrated Circuit (3D-IC) Testing Technology", pp. 235-268.

Section 8.7: Masaki Hashizume, Hiroyuki Yotsuyangi, Shyue-Kung Lu and Zvi Roth, "Electrical Interconnect Tests of Open Defects in a 3D-IC with Built-In Supply Current test Circuit", pp. 258-268. (same as Refereed Conference paper 18).

4. Ying Bai, Hanqi Zhuang and Zvi Roth, Chapter 6: "Apply a Fuzzy Logic Controller to Suppress Noises and Coupling Effects for a Laser Tracking System", in "Advanced Fuzzy Logic Technologies in Industrial Applications", Edited by Ying Bai, Hanqi Zhuang and Dali Wang, Springer 2006 (Advances in Industrial Control), pp. 83-98.
3. H. Zhuang and Z. S. Roth, "A Unified Approach to Kinematic Modeling, Identification and Compensation for Robot Calibration", in "Control and Dynamic Systems, Advances in Theory and Applications", Volume 39: Advances in Robotic Systems, Part 1, Edited by C. T. Leondes, Academic Press, 1991, 71-127.
2. Z. S. Roth, "Self-Repair and Self-Organizing Robots", International Encyclopedia of Robotics, Edited by R. C. Dorf, John Wiley & Sons, 1988, Vol. 3, 1476-1485.
A shorter version of this Chapter is in:
Concise International Encyclopedia of Robotics--Applications and Automation, Edited by R. C. Dorf, John Wiley & Sons, 1990, 862-867.
1. Y. Shamash, Y. Yang and Z. S. Roth, Teaching a Robot, International Encyclopedia of Robotics, Edited by R. C. Dorf, John Wiley & Sons, 1988, Vol. 3, 1689-1701.
A shorter version of this Chapter is in:
Concise International Encyclopedia of Robotics--Applications and Automation, Edited by R. C. Dorf, John Wiley & Sons, 1990, 969-976.

III. Book Contracts

1. Ying Bai and Zvi Roth, "Modern Controls with Microcontrollers: Design, Implementation and Applications", (estimated 600 pages, with 150 illustrations), Springer International Publishing AG; Contract Signed on 9/27/2017. Promised Delivery Date: 9/1/2018. (Book Submitted on 8/1/2018).

4.2.4. Non-refereed Publications

58. Mirjana Pavlovic and Zvi Roth, "Establishment of Bioengineering Teaching Lab", XV LACCEI International Multi-Conference for Engineering, Education & Technology, Work in Progress Paper WP #551, July 19-21, 2017, Boca Raton, FL
57. Aura-Maria Cardona, Zvi S. Roth and Chingping Han, "Queue Clearing and Throughput Enhancement Strategies in Biotechnology Automation", Proceedings of FCRAR 2015, 2015 Florida Conference on Recent Advances in Robotics, Florida Institute of Technology, Melbourne, May 14-15, 2015.
56. Luna L. Gloria and Zvi S. Roth, "Implementation Considerations in the Optimization of a Microgrid Centralized Control", Proceedings of FCRAR 2014, 2014 Florida Conference on Recent Advances in Robotics, Florida International University, Miami, May 8-9, 2014.
55. Rosana Melendez-Norona, Zvi S. Roth and Hanqi Zhuang, "Design Considerations of Power Management Control Strategies for Micro-Grid Systems", Proceedings of FCRAR 2014, 2014 Florida Conference on Recent Advances in Robotics, Florida International University, Miami, May 8-9, 2014.
54. Aura-Maria Cardona, Zvi S. Roth and Chingping Han, "Modular Implementation of Laboratory Unit Operations (LUOs) for Automation of Biotechnology Protocols", Proceedings of FCRAR 2014, 2014 Florida Conference on Recent Advances in Robotics, Florida International University, Miami, May 8-9, 2014.
53. Aura-Maria Cardona, Zvi S. Roth and Chingping Han, "Group Technology (GT) Applied to Biotechnology Automation", Proceedings of FCRAR 2014, 2014 Florida Conference on Recent Advances in Robotics, Florida International University, Miami, May 8-9, 2014.
52. Aura-Maria Cardona and Zvi S. Roth, "Throughput Specifications for Upstream Biotechnology Process Automation to Meet the Needs of Automated Drug Discovery Campaigns", Proceedings of FCRAR 2012, 2012 Florida Conference on Recent Advances in Robotics, Boca Raton FL, May 10-11 2012 (6 pages).
51. Banton, S.A., Roth, Z., Pavlovic, M. A Bioengineering Approach to *Rational Vaccine Design towards the Ebola Virus*. 6th Annual International Society for Computational Biology (ISCB) Student Council Symposium, Boston, Massachusetts, July 9, 2010. Oral presentation
50. Banton, S.A., Roth, Z., Pavlovic, M., Zhuang, H. *Mathematical Modeling of Ebola Virus Dynamics towards Rational Vaccine Design: The Humoral Immune Response*. 36th

- Northeastern Bioengineering Conference 2010 (NEBEC) (Columbia University), 26 March – 28 March, 2010, New York, New York.
49. Sophia Banton and Zvi Roth, “Identification of Novel Epitopes of the Ebola Virus for Rational Vaccine Design”, Abstract and Poster Presentation, Rocky Mountain Bioinformatics Conference (Rocky 09), December 10, 2009 – December 12, 2009, Aspen, Colorado.
 48. Sophia Banton and Zvi Roth, “Mathematical Modeling of Ebola Virus Dynamics as a Step Towards Rational Vaccine Design”, Abstract and Poster Presentation, The 21st Annual International Conference on Antibody Engineering and Immunotherapeutic for the 21st Century (IBC), December 5, 2009 – December 9, 2009, San Diego, Ca.
 47. Aura-Maria Cardona, Chingping Han and Zvi S. Roth, “Optimization of Multi-Centrifuge Steps in Biotechnology Automation”, Proceedings of FCRAR 2009, Florida Conference on Recent Advances in Robotics, May 21-22, 2009, Florida Atlantic University, Jupiter, Florida (10 pages);
 46. Aura-Maria Cardona and Zvi S. Roth, “Design Considerations in High-Throughput Automation for Biotechnology”, Proceedings of FCRAR 2008, Florida Conference on Recent Advances in Robotics, May 8-9, 2008, Florida Institute of Technology, Melbourne Florida (11 pages); Winner of Best Paper Award.
 45. David C. Sheats, Zvi S. Roth and Joseph W. Snyder, “Modeling Aspects of Temperature Controlled Cryogenic Processes”, Proceedings of FCRAR 2006, Florida Conference on Recent Advances in Robotics, May 25-26 2006, Florida International University, Miami Florida. (5 pages).
 44. David C. Sheats, Zvi S. Roth, Jon K. Burford and Joseph W. Snyder, “Simulation Studies of the SI PID Control Autotuning”, Proceedings of FCRAR 2005, Florida Conference on Recent Advances in Robotics, May 5-6 2005, University of Florida, Gainesville Florida. (13 pages).
 43. David Sheats, Zvi S. Roth, Mark Sheats and Elizabeth Srehlow, “Autotune of PID Cryogenic Temperature Control Based on Closed-Loop Step Response Tests”, Proceedings of FCRAR 2004, Florida Conference on Recent Advances in Robotics, May 6-7 2004, University of Central Florida, Orlando Florida. (7 pages).
 42. Zvi S. Roth, “The Making of the “Bio-Systems Modeling and Control” Course”, Proceedings of FCRAR 2004, Florida Conference on Recent Advances in Robotics, May 6-7 2004, University of Central Florida, Orlando Florida (30 pages)
 41. Cristian Popescu, Yuan Wang and Zvi S. Roth, “Passivity Based Control of Spring Coupled Underactuated Horizontal Double Pendulums”, Proceedings of FCRAR

- 2003, Florida Conference on Recent Advances in Robotics, May 8-9 2003, SeaTech, Dania Beach, Florida (17 pages)
40. Zvi .S. Roth, "Computer-Aided Control Systems Course Instruction", Proceedings of the 2002 Florida Conference on Recent Advances in Robotics, Florida International University, Miami, Florida, May 2002.
- Also in World Automation Congress (WAC) 2002, Invited Session on Robotics and Control Education, June 9-13, 2002, Orlando, Florida. In *Robotics, Manufacturing, Automation and Control*, Vol. 14, TSI Press(Ed. M. Jamshidi et al.), pp.389-394.
39. Zvi S. Roth, "The Role of Robotics in Freshmen Engineering Curricula", Accepted to World Automation Congress (WAC) 2002, Invited Session on Robotics and Control Education, June 9-13, 2002, Orlando, Florida. In *Robotics, Manufacturing, Automation and Control*, Vol. 14, TSI Press (Ed. M. Jamshidi et al.), pp.405-410.
38. Z.S. Roth, "An Interdisciplinary Hands-on Freshmen Engineering Course", Proceedings of the 2000 Florida Conference on Recent Advances in Robotics, Florida Atlantic University, SeaTech, Dania, Florida.
http://www.eng.fau.edu/conf/fcrar2000/papers/EGN1002_FCRAR_2000.pdf.
37. Zhuang, S. Hu-Motaghedi and Z.S. Roth, " Robot Calibration with Planar Constraints", Proceedings of the 2000 Florida Conference on Recent Advances in Robotics, Florida Atlantic University, SeaTech, Dania, Florida.
http://www.eng.fau.edu/conf/fcrar2000/papers/puma_paper_3.pdf.
36. H. Zhuang, S. Hu-Motaghedi, Z.S. Roth and Y. Bai, " Self Calibration of Laser Tracking Systems", Proceedings of the 2000 Florida Conference on Recent Advances in Robotics, Florida Atlantic University, SeaTech, Dania, Florida.
http://www.eng.fau.edu/conf/fcrar2000/papers/LTS_paper.pdf
35. Y. Bai, Z. S. Roth and H. Zhuang, "Control Considerations in the Design of a Laser Tracking CMM", Proceedings of the 1997 Florida Conference in Recent Advances in Robotics, Florida International University, Miami, April 10-11, 1997, pp. 160-166.
34. H. Zhuang, Z. Roth and S. Hu, "Observability Studies of Laser Tracking Measuring Systems Under Plane Constraints", Proceedings of the 1996 Florida Conference on Recent Advances in Robotics, April 1996, Boca Raton, Florida, pp. 337-354.
33. Y. Bai, Z. Roth and H. Zhuang, "Stability Analysis of a Fuzzy Logic Controller", Proceedings of the 1996 Florida Conference on Recent Advances in Robotics, April 1996, Boca Raton, Florida, pp. 325-336.

32. S. Hu, Z. S. Roth and H. Zhuang, "Issues in Self-Calibration of Single-Beam Laser Tracking Systems", Proceedings of the 1995 Florida Conference on Recent Advances in Robotics, April 26, 1995, Orlando, Florida, pp.106-113.
31. Y. Bai, H. Zhuang and Z. S. Roth, "Design and Implementation of a Fuzzy Logic Controller for a Laser Tracking Cnn", Proceedings of the 1995 Florida Conference on Recent Advances in Robotics, April 26, 1995, Orlando, Florida, pp.29-33.
30. D. Raviv, E. W. Djaja and Z. S. Roth, "Technique for Enhancing the Closed-Loop Performance of Digital Controllers Obtained from Discretization of Analog Controllers", NIST Technical Report, #NISTIR 5527, November 1994.
Also in:
Proceedings of the 1995 Florida Conference on Recent Advances in Robotics, April 26, 1995, Orlando, Florida pp.114-132.
29. H. Zhuang, Z. S. Roth, Y. Bai, L. Liu and J. Yan, "Prediction of Mirror Center Offset Using Low-Resolution Encoders in a Laser Tracking Measurement System", Proceedings of the 1994 Florida Conference on Recent Advances in Robotics, April 1994, Gainesville, Florida, pp. 49-54.
28. Z. S. Roth, H. Zhuang and S. Hu, "A Control Architecture for a Laser Tracking Coordinate Measuring Systems", Proceedings of the 1994 Florida Conference on Recent Advances in Robotics, April 1994, Gainesville, Florida, pp. 153-158.
Also in:
International AMSE Conference: Systems Analysis, Control and Design, SYS'94, Lyon France, July 1994 Vol. 3, pp. 3-8.
27. Xangdong Xie and Zvi Roth, "Development of Systematic Control Tuning Method for Robot Manipulators", Final Report submitted to Sankyo Seiki (America) Inc., Robotics Division, Boca Raton, Florida, June 1993.
26. Xangdong Xie and Zvi Roth, "The Control Tuning Cookbook" (for Sankyo SR5C and Similar robots), Project Report submitted to Sankyo Seiki (America) Inc., Robotics Division, Boca Raton, Florida, June 1993.
25. Jian Wang and Zvi Roth, "SR5CSCARA Robot Controller Design and Tuning", Final Report submitted to Sankyo Seiki (America) Inc., Robotics Division, Boca Raton, Florida, September 1992.
24. Jiahua Yan, Zvi S. Roth, Hanqi Zhuang and Roy Smollett, "Error Analysis and Parameter Optimization of a Spherical Retro-Reflector", Proceedings of the 5th Annual Conference on Recent Advances in Robotics, Florida Atlantic University June 11-12, 1992, pp. 188-198.

23. Hanqi Zhuang, Luke K. Wang and Zvi S. Roth, "A Simulated Annealing Approach to Optimal Selection of Measurement Configurations for Robot Calibration", Proceedings of the 5th Annual Conference on Recent Advances in Robotics, Florida Atlantic University, June 11-12, 1992, pp 630-644.
22. Hanqi Zhuang and Zvi S. Roth, "Modeling and Self-Calibration of Single-Beam Laser Tracking System Having Gimbal Axis Misalignment and Mirror Center Offset", Proceedings of the 5th Annual Conference on Recent Advances in Robotics, Florida Atlantic University, June 11-12, 1992, pp. 660-679.
21. H. Zhuang, Z. S. Roth and K. Wang, "Robot Calibration Using a Modified Denavit Hartenberg Model", Proceedings of the 5th Annual Conference on Recent Advances in Robotics, Florida Atlantic University, June 11-12, 1992, pp. 602-629.
20. H. Zhuang, Z. S. Roth and K. Wang, "Preliminary Study of Robot Calibration by Mobile Camera System", Proceedings 4th Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton Florida, pp. 127-144, May 1991.
19. H. Zhuang and Z. S. Roth, "Method for Kinematic Calibration of Stewart Platforms", Applications of Modeling and Identification to improve Machine Performance, DSC-Vol. 29, pp. 43-48, ASME Winter Annual Meeting, Atlanta, Georgia, December 1991
18. H. Zhuang and Z.S. Roth, "Method for Kinematic Calibration of Stewart Platforms", Proceedings of the 4th Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton, Florida, pp. 156-168, May 1991.
17. H. Zhuang, Z.S. Roth and R. Sudhakar, "Practical Fusion Algorithms for Rotation Matrices", Proceedings 4th Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton Florida, pp. 330-346, May 1991.
16. H. Zhuang, Z. S. Roth and R. Sudhakar, "Application of Quaternions to World Coordinates Identification of Robot Manipulators", Proceedings 4th Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton Florida, pp. 145-155, May 1991.
15. X. Xie, B. Li, H. Zhuang and Z. S. Roth, "Mirror Center Offset Elimination of a Multi-Beam Laser Tracking Systems", Proceedings 4th Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton Florida, pp. 117-126, May 1991
14. K. Wang, H. Zhuang and Z. S. Roth, "Analysis of Perspective Projection Distortion Effects on the Image Coordinate Computation of Camera Calibration Points", Proceedings 4th Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton Florida, pp. 169-180. May 1991.

13. H. Zhuang and Z. S. Roth, "Design and Calibration of a Stereo Camera Tracking Systems", 3rd Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton Florida, May 1990. (Extended Summary)
12. H. Zhuang, Z. S. Roth and B. Li, "Design and Calibration of a Laser Tracking Machine with Passive Position and Orientation Measurement Capability", 3rd Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton Florida, May 1990. (Extended Summary)
11. X. Xu, H. Zhuang and Z. S. Roth, "A Very Fast Camera Calibration Method for High Accuracy 3D Measurement Using Cameras with Unknown Specifications", 3rd Conference on Recent Advances in Robotics, Florida Atlantic University, Boca Raton Florida, May 1990. (Extended Summary)
10. S. Chen, Z. S. Roth, Z. Gershgoren and S. Y. Shao, "Stereo Vision for Robot Calibration", Proceedings of the Second Conference on Recent Advances in Robotics, Florida Atlantic University, pp. 163-173, May 1989.
9. Z. S. Roth and H. H. Yakali, "Interactive Computer Aided Digital Control Design", Technical Report, Florida Atlantic University, Robotics Center, January 1989.
8. Z. S. Roth, "Research and Development Issues in the Implementation of On-Line Robot Calibration", Proceedings of PROCIM'88--The First Annual Conference on Productivity Through Computer Integrated Manufacturing, Orlando, Florida, November 1988.
7. Z. S. Roth, "Robotics Research at Florida Atlantic University", Proceedings of PROCIM'88--The First Annual Conference on Productivity Through Computer Integrated Manufacturing, Orlando, Florida, November 1988.
6. M. Dubbury and Z. S. Roth, "Minimum Overshoot Digital Control Design Strategy", Proceedings of the First Conference on Recent Advances in Robotics, Florida Atlantic University, Robotics Center, May 1988. (Extended Summary)
5. M. R. Driels, B. W. Mooring, L. J. Everett and Z. S. Roth, "Fundamentals of Robot Calibration", Lecture Notes for the Tutorial on Robot Calibration, 1988 IEEE International Conference on Robotics and Automation, April 25, 1988.
4. R. E. Floyd and Z. S. Roth, "Industrial Robots Versus Educational Robots: Why the Difference?", Third International Robotic Systems Education and Training Conference, Detroit, Michigan, August 1986.
3. Z. S. Roth, "Modeling and Control of SEDAB Electric Drive Robot", IBM Technical Report, TR-54.379, 1985.

2. T. Georgiou, F. Hamano, Z. Roth and Y. Shamash, "Robotics in Engineering Curriculum", 1984 Frontiers in Education Conference Proceedings, Philadelphia, Pennsylvania, October 1984.
1. J. Preminger and Z. S. Roth, "Analysis of Control Systems Linked Through a Sinusoidal Element", Proc. of IEEE, Israel Section, XIII Conference on Israeli Section IEEE, Tel Aviv, March 1983.

4.2.5. Submitted Papers (other than journal)

N/A

4.2.6. Theses and Dissertations by Zvi Roth

1. Zvi S. Roth, "Nonlinear Filtering for Systems with Random Structure", Ph.D. Dissertation, Case Western Reserve University, 1982. (Advisor: Dr. K. A. Loparo)
2. Zvi S. Roth, "Analysis of Control System Interconnected Through a Nonlinear Element of the Type $f(x)=\sin(x)$ ", M. Sc. Thesis, The Technion, Israel institute of Technology, 1979 (in Hebrew). (Advisor: Dr. J. Preminger)

a. Presentations

26. Zvi S. Roth, "Modern Approach to Submicron CMOS Analog Circuit Design", FAU CEECS Department Weekly Seminars, April 11, 2014.
25. Zvi S. Roth, "Modern Approach to Submicron CMOS Analog Circuit Design", Invited Presentation, Ort Braude Engineering Academic College, Department of Electrical and Electronics Engineering Monthly Seminars, May 22, 2013.
24. Banton, S.A., Roth, Z., Pavlovic, M. A Bioengineering Approach to *Rational Vaccine Design towards the Ebola Virus*. 6th Annual International Society for Computational Biology (ISCB) Student Council Symposium, Boston, Massachusetts, July 9, 2010.
23. Banton, S.A., Roth, Z. *Mathematical Modeling of Ebola Virus Dynamics as a Step towards Rational Vaccine Design*. 26th Southern Biomedical Engineering Conference 2010, 30 April - 2 May 2010, College Park, Maryland
22. Aura-Maria Cardona, Zvi S. Roth and Chingping Han, "Strategies for Queue Clearing and Throughput Enhancement in Biotechnology Automation Design", The 23rd Annual Florida Conference on Recent Advances in Robotics (FCRAR

- 2010), May 20-21, 2010, University of North Florida, Jacksonville, Florida. No paper in the proceedings. Presentation only: Zvi Roth presented the paper on May 20, 2010.
21. March 12, 2007, “Open Research Issues in Linear and Nonlinear Control of Biological and Physiological Systems”, Invited Seminar in the Symposium on Academic Activities in Engineering: Exchange among International Affiliated Double-Degree Program Partner Institutions, Tokushima University, Japan.
 20. May 14, 2006, “The Making of a “Bio-Systems Modeling and Control “ Course”, Invited Seminar at the Technion Israel Institute of Technology, Department of Science and Technology Education.
 19. January 18, 2006, “The Florida-Israel Institute – History, Mission and Joint Florida-Israel Research Collaboration Opportunities”, Invited seminar at Holon Academic Institute of Technology, Holon, Israel.
 18. May 8, 2001, "Development of an Interdisciplinary Hands-on Freshmen Engineering Course", Invited lecture at the Department of Science and Technology Education, Technion, Israel Institute of Technology.
 17. August 22, 1995, “Robotics Today”, Invited Lecture at the Platina Club, Boyton Beach, Florida.
 16. February 10 and 17, 1995, “Sliding Mode Control -- A Two-Part Tutorial” Presented at the FAU Robotics Center Seminars.
 15. July 26, 1994, “Calibration of Laser Tracking Coordinate Measuring Machines”, Invited Lecture at Technomatix Technologies, Hertzelia, Israel.
 14. July 19, 1994, “Robot Calibration Workshop” at the Mechanical Engineering Department, The Technion, Israel Institute of Technology.
Lecture 1: “Introduction of Robot Calibration and Kinematic Models”
Lecture 2: “Kinematic Identification and Compensation”
 13. July 14, 1994, “Camera-Aided Robot Calibration”, Invited Seminar at the Computer Science Department, Hebrew University, Jerusalem, Israel.
 12. January 28, 1994 "Robotics Research at Florida Atlantic University", 1993-1994 FAU Research Lectures Series.
 11. December 3, 1992 "Robot Calibration--Recent Research Issues: Calibration of Laser Tracking Systems and Calibration of Stewart Platforms", Invited Mechanical Engineering Seminar, The Technion, Israel Institute of Technology, Haifa, Israel.

10. December 1, 1992 "Vision-Based Robot Calibration" Invited Seminar at the Computer Science/Electrical Engineering Pixel Club, The Technion Israel Institute of Technology, Haifa, Israel.
9. April 27, 1992 "Self-Calibration of Laser Tracking Systems", Invited Lecture at Florida Atlantic University, Center for Complex Systems Workshop Honoring Professor Herman Haken.
8. February 18, 1992 "Research Issues in Robot Calibration", Invited Lecture at Florida State University, Department of Mechanical Engineering Weekly Seminars, Tallahassee, Florida.
7. October 1991 "Research issues in Robot Calibration", Invited Lecture at Florida Institute of Technology, Department of Mechanical Engineering, Monthly Seminar Series, Melbourne, Florida
6. July 1990 "The FAU Laser Tracking System", Presentation at NIST, Gaithersburg, Maryland.
5. February 13, 1987 "Overview of Robot Calibration", Motorola Monthly Lecture Series.
4. June 22, 1987 "Nonlinear Filtering for Failure Detection Problem", Invited Lecture at Tel-Aviv University, Israel, Electrical Engineering Department.
3. June 15, 1987 "Overview of Robot Calibration", Invited Lecture at the Technion, Israel Institute of Technology, Department of Mechanical Engineering.
2. March 23, 1987 "Robotics Research at FAU", FAU Student Chapter IEEE Meeting.
1. March 5, 1987 "Robotics", Invited Lecture at CENTECH, West Palm Beach Center Village Technion Society.

b. Poster Presentations

6. Mirjana Pavlovic and Zvi Roth, "Establishment of Bioengineering Teaching Lab", XV LACCEI International Multi-Conference for Engineering, Education & Technology, Poster, July 19-21, 2017, Boca Raton, FL
5. Banton, S.A., Roth, Z., Pavlovic, M. "*Novel Epitopes of the Ebola Virus Towards Rational Vaccine Design: Virus Evolution and Protein Conservation*". 18th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB). Boston, Massachusetts, July 11-13, 2010.

4. Banton, S.A., Roth, Z., Pavlovic, M., Zhuang, H. *Mathematical Modeling of Ebola Virus Dynamics towards Rational Vaccine Design: The Humoral Immune Response*. 36th Northeastern Bioengineering Conference 2009 (Columbia University), 26 March – 28 March, 2010, New York, New York. (*Accepted*)
3. Banton, S.A. *“Identification of Novel Epitopes of the Ebola Virus Towards Rational Vaccine Design, Virus Evolution, and Protein Conservation*. International Society for Computational Biology 2010 Latin America Conference. Montevideo, Uruguay, March 13-16, 2010.
2. Banton, S.A. *“Identification of Novel Epitopes of the Ebola Virus for Rational Vaccine Design*. International Society for Computational Biology (ISCB) 2009 Rocky Mountain Bioinformatics Conference. Aspen/Snowmass, Colorado, USA. December 10-12, 2009.
1. Banton, S.A., Roth, Z., Pavlovic, M. *Rational Vaccine Design of the Ebola Virus; A Bioengineering Approach*. FAU Graduate Student Research Day, April 9, 2010.

5. Research

5.1.Sponsored Research

5.1-1. Funded Projects

- | | | |
|-----|--------------------------|--|
| 21. | Principal Investigator: | Ali Zilouchian (heading a FAU Faculty Team of which Z. Roth is a member) |
| | Project Title: | Development of Mechanical, Environmental and Biomedical Engineering Education Modules for Middle School Students |
| | Funding Agency: | Broward County School Board |
| | Duration: | 1 year (starting July 2011) |
| | Amount: | \$50,000 |
| | | |
| 20. | Principal Investigators: | Joseph Ouslander and Ruth Tappen (heading a FAU Faculty Team of which Z. Roth is a member) |
| | Project Title: | Healthy Aging: Interdisciplinary research to Improve the Quality of Life and Quality of Care to Aging Americans |
| | Funding Agency: | Florida Atlantic University Division of Sponsored Research, FAU Research Priorities Competition |
| | Duration: | 3 years (starting August 2010) |
| | Amount: | \$500,000 |
| | | |
| 19. | Principal Investigators: | Hanqi Zhuang, Oren Masory and Zvi Roth |

- Project Title: Result-Oriented Multidisciplinary Capstone Design to Aid Persons with Disabilities
Funding Agency: National Science Foundation (RAPID Program, Grant Number 1033815)
Duration: July 1 2011 – June 31 2016.
Amount: \$125,000
18. Principal Investigator: Zvi Roth
Project Title: Development of Control Models for Tool Evaluation
Funding Agency: T-VEC Technologies, Boca Raton, FL
Duration: January 2009 – May 2009
Amount: \$11,715
17. Principal Investigator: Zvi Roth
Project Title: Development of Control Models for Tool Evaluation
Funding Agency: T-VEC Technologies, Boca Raton, FL
Duration: August 2008 – December 2008
Amount: \$11,085
16. Principal Investigator: Zvi Roth
Project Title: Development of Control Models for Tool Evaluation
Funding Agency: T-VEC Technologies, Boca Raton, FL
Duration: January 2008 – May 2008
Amount: \$11,658
15. Principal Investigator: Zvi Roth
Project Title: Development of Control Models for Tool Evaluation
Funding Agency: T-VEC Technologies, Boca Raton, FL
Duration: August 2007 – December 2007
Amount: \$8,673
14. Principal Investigator: Hanqi Zhuang and Zvi Roth
Project Title: Integration of a Telecommunication System
Funding Agency: Radisys Corporation
Duration: August 1999 - April 2000
Amount: \$23,500
13. Principal Investigator: Hanqi Zhuang and Zvi Roth
Project Title: Digital Interface for a Telecommunication System
Funding Agency: IMMIX TeleCom Inc.
Duration: August 1999 - April 2000
Amount: \$11,700

12. Principal Investigator: Zvi S. Roth and Nurgun Erdol
Project Title: Optical Defect Analyzer
Funding Agency: IBM, Boca Raton
Duration: July 5, 1995-December 31, 1995
Amount: \$23,310
11. Principal Investigator: Zvi S. Roth and Hanqi Zhuang
Project Title: Upgrade of a Laser Tracking Coordinate Measuring Machine for Calibration of Machine Tools and Robots, (Research Equipment Grant), DDM-9310420 10.
Funding Agency: National Science Foundation
Duration: September 1, 1993-August 31, 1995
Amount: \$40,745
Institutional Matching: \$40,746 (from FAU)
12. Principal investigator: Zvi. S. Roth
Project Title: Development of Systematic Control Tuning Methods for Robot Manipulators
Funding Agency: Sankyo Seiki (America), Inc., Robotics Division, Boca Raton, Florida
Duration: January 27, 1993 - May 21, 1993
Amount: \$12,413
9. Principal Investigator: Zvi S. Roth
Project Title: Controller Design for a SR5C Sankyo SCARA Robot
Funding Agency: Sankyo Seiki (America) Inc., Robotics Division, Boca Raton, Florida
Duration: June 1, 1992 -August 31, 1992
Amount: \$6,547
8. Principal Investigator: Zvi S. Roth
Project Title: Advanced Robotics Research
Funding Agency: Florida High Technology and Industry Council
Duration: October 1986 - June 1987
Amount: \$260,000
Comment: This first year personal grant evolved later into a state funded budget for the FAU Robotics Center
1987-1988: \$400,000
1988-1980: \$400,000

1989-1990: \$400,000
1990-1991: \$390,000
1991-1992: \$370,000
1992-1993: \$340,000
1993-1994: \$340,000

7. Principal Investigator: Zvi S. Roth
Project Title: Development of Education Robotics Programs and Experiments
Funding Agency: Technovate, Inc., Pompano Beach, Florida
Duration: January 1986 - December 1986
Amount: \$10,500
6. Principal Investigator: Zvi S. Roth
Project Title: Calibration of the EDR Robot
Funding Agency: IBM Corporation, Boca Raton, Florida, Process Automation Group, Manufacturing Systems Projects
Duration: January 1985-December 1985
Amount: \$27,000
5. Principal Investigator: Zvi S. Roth
Project Title: Intelligent Motion of the Hero-1 Robot
Funding Agency: EIES, FAU
Duration: January 1984-December 1984
Amount: \$3,500
4. Principal Investigator: T. Georgiou, Y. Shamash;, Zvi S. Roth (involvement: 20%)
Project Title: Development of a Robotic Instrumentation Laboratory
Funding Agency: Technovate, Inc., Pompano Beach. Florida
Duration: January 1984-December 1984
Amount: \$20,000
3. Principal Investigator: Z. Roth (involvement: 75%), Y. Shamash and F. Hamano
Project Title: Modeling and Control of IBM EDR Robot
Funding Agency: IBM Manufacturing Systems Projects, Boca Raton, Florida
Duration: January 1983-December 1983
Amount: \$12,000
2. Principal investigator: Y. Shamash, F. Hamano and Z. Roth (involvement:20%),
Project Title: Optimal Control of IBM Enterprise

- | | |
|----------------------------|--|
| Funding Agency: | Robot IBM Manufacturing Systems
Projects, Boca Raton, Florida |
| Duration: | January 1983 - December 1983 |
| Amount: | \$15,000 |
| | |
| 1. Principal Investigator: | Y. Shamash, M. Shasavari and Z. Roth
(involvement:33%), |
| Project Title: | Investigation of Hierarchical Control System
for the Integrated Communication System of
the U. S. Navy |
| Duration: | October 1982 -January 1983 |
| Amount: | \$7,000 |

Total: \$3,347,086 (of which **\$2.9 millions** count as State of Florida annual funding to the FAU Robotics Center, with Dr. Roth as PI, obtained from October 1986 till June 1994). The Robotics Center has graduated over 30 PhDs from the late 80's till the early 2000's period. [Items 20-21 are not counted]

5.2. Unsponsored Research

Not applicable

5.3. Pending Proposals

N/A

6. Professional Service

6.1. Membership in Professional Societies

1. Senior Member of IEEE (Inactive Membership)

6.2. Professional Registration

1. Professional Engineer Registered in the State of Florida
 Year Registered 1985
 Present Status Non Active
 Certificate Number PE 0036879

6.3. Dissemination of Technical Information

1. Dr. Roth's full set of PowerPoint lecture notes and other course material (simulation projects with full solutions) for the "CMOS Amplifiers" course has been posted on the

McGraw-Hill web page for Behzad Razavi's "Design of Analog CMOS Integrated Circuits" since June 2003.

2. Links to full www.vimeo.com video courses can be found in Dr. Roth's Personal Web Page: <http://faculty.eng.fau.edu/rothz> including table of contents for all videos. Links are: www.vimeo.com/album/226381 for EEE 3300 Electronics 1, www.vimeo.com/album/166900 for EEE 4361 Electronics 2, www.vimeo.com/album/1751862 for EEL 4652 Control Systems 1 and www.vimeo.com/album/1663456 for BME 5742 Biosystems Modeling and Control (the latter has full set of posted PowerPoint lecture notes).

6.4. University Service

6.4.1. Administrative Positions

- 8/13-10/13 Acting Chair, Computer & Electrical Engineering & Computer Science Department
- 8/09-8/13 Associate Chair, Computer & Electrical Engineering & Computer Science Department
- 9/05-10/08 Interim co-Director, Florida-Israel Institute

The Florida-Israel Institute (FII) is a unique public organization administered jointly by Florida Atlantic University (FAU) and Broward Community College (BCC). Its primary purpose is to promote the development of enhanced economic, cultural, educational and social ties between the States of Florida and Israel. Implementation of this mission is achieved through the formation of cooperative initiatives in research, academic development, student and faculty exchange, cultural exchange, and technical assistance between FAU, BCC and cooperating Israeli institutions of higher learning, as well as with private sector commercial interests.

Two groups assist FII in carrying out its mission: an all-purpose advisory committee consisting of members from academics, government and private industry; and a faculty committee which focuses exclusively on the academic activities of FII.

FII was originally created by the state legislature as one of thirteen linkage institutes which paired public postsecondary institutions with selected foreign countries to enhance interactions between those countries and Florida.

As part of FII mission as a linkage institute, FII administers tuition exemption scholarships to Israeli students who study at the Florida public higher education system.

2005-2006 FII Budget - \$83,000 (provided jointly by FAU and BCC)

2006-2007 FII Budget - \$200,000 direct appropriation by the State of Florida Legislature

2007-2008 FII Budget - \$50,000 direct appropriation by the State of Florida Legislature, supplemented by \$37,000 from BCC.

2008-2009 FII Budget - \$0 appropriation by the State of Florida, \$33,000 supplement by Broward College.

- 9/85-8/94 Director, FAU Robotics Center
- The Center was a State funded Center. State funding: \$400,000 (1987-1988), \$400,000 (1988-1989), \$400,000 (1989-1990), \$390,000 (1990-1991), \$370,000 (1991-1992), \$340,000 (1992-1993), \$340,000 (1993-1994). The Center employed 3 full-time faculty, 1 lab manager, 2-3 Visiting engineers and 10-15 graduate students annually. Total equipment value in the Robotics Lab exceeded 2 million dollars. Over the years Center fully funded 30 Ph.D. students who successfully graduated. The Robotics Center main research areas were:
- (1) Accuracy enhancement of robots and machine tools
 - (2) Active vision and its applications to intelligent control of vehicles
 - (3) Space telerobotics
 - (4) Neural networks and their applications to navigation and control of vehicles and to adaptive control of machine tools, and
 - (5) Advanced mechanisms -- kinematics of hybrid and parallel manipulators.

6.4.2. University Committees

6. Member, College of Science Academic Review Committee, Physical and Mathematical Sciences Sub-Committee (Spring 2001-Summer 2001).
5. Member, SACS Accreditation, Graduate Studies Sub-committee, (Fall 1999 - Fall 2001)
4. Member, SACS Accreditation, Distance Learning Sub-committee, (Summer 2000 - Fall 2001).
3. Chairman, University Committee on Statistics (1990-1992) During Spring 1992 the Committee developed a comprehensive proposal for the formation of a new Department of Statistics within the College of Science at FAU. The Committee is presently assisting the Mathematics Department to develop a request to the Board of Regents for authorization to plan a M. S. Degree Program in Statistics.
2. Member, University Committee on Honorary Degrees (academic year 1989/1990)
1. Member, University Academic Freedom and Due Process Committee (1984-1986)

6.4.3. College of Engineering Committees

21. Chair, College of Engineering & Computer Science Bioengineering Steering Committee (Spring 2016 – 2017)
20. Member, College of Engineering & Computer Science ad-hoc Committee for the Revision of the EGN 1002 Fundamentals of Engineering course (Spring 2016)
19. Member, College of Engineering & Computer Science Graduate Studies Committee (Fall 2014 – 2017)
18. Member, Ocean & Mechanical Engineering Department Faculty Search Committee (Fall 2013-Spring 2014)

17. Elected Member, College of Engineering & Computer Science ad-hoc Acting Dean Search Committee, Summer 2010.
16. Member, College of Engineering & Computer Science Enrollment Management Committee (Fall 2010 – Summer 2012)
15. Member, College of Engineering & Computer Science Undergraduate Petitions Committee (Fall 2010 – Summer 2013)
14. Member, College of Engineering & Computer Science Undergraduate Studies Committee (Fall 2010 – Summer 2012)
13. Member, College of Engineering Policy and Development Committee (Fall 2001-Summer 2002).
12. Chair, College Policy and Development Committee (Fall 1999 - Summer 2001)
11. Member, College Policy and Development Committee (Fall 1991-Summer 1993)
10. Secretary, College Policy and Development Committee(Fall 1991-Summer 1992)
9. Member, Ad-hoc Committee on Long Term Planning 1993-1998 (February-March 1992)
8. Member, Search Committee for Associate Dean for Resource Development (Summer 1991)
7. Member, Ad-hoc Committee on Structure and Governance (Fall 1990), The Committee developed the first draft of the College By Laws.
6. Member, College Ad-hoc Committee - Science and Engineering Building Equipment (1989)
5. Chairman, College Curriculum Committee (1987/1988) member (1988/1989)
4. Chairman, College Mathematics Committee (1988/1989)
3. Member, College Mathematics Committee (1987/1988,1989/1990)
2. Chairman, College Search Committee, Robotics Center Positions (1987-1988)
1. Organizer, College Distinguished Lecturer Series (1984-1987)

6.4.4. Computer & Electrical Engineering & Computer Science Departmental Committees

22. Chair, CEECS Department Teaching Assistants and Graduate Assistants Committee (Fall 2015 – present).
21. Member, CEECS Department EE Faculty Search Committee (Fall 2015 – Summer 2016)
20. Chair, CEECS Department Faculty Search Committee (Fall 2013 – Summer 2014)
19. Member, CEECS Graduate Committee (Fall 2013 – present)
18. Chair, Bioengineering Program Committee (2009-2014)
17. Chair, Electrical Engineering BS Program Committee (Fall 2009 – Summer 2012)
16. Member, Electrical Engineering BS Program Committee (Fall 2013-Summer 2014)
15. Member, Bioengineering M.S. Degree Planning Forum (2005-2006).
14. Chair, Electrical Engineering Academic Affairs Committee (2003-2004)
13. Member, Department Chairman Three - Year Comprehensive Evaluation Committee (Spring 2001-Fall 2001).

12. Member, Electrical engineering Academic Affairs Committee (Fall 2001-Summer 2009)
11. Chair, Electrical Engineering Academic Affairs Committee (Fall 1998 - Summer 2001). Also chaired all meetings of the Electrical Engineering ABET 2000 Preparation Team. (Fall 1999 – Summer 2009).
10. Member, Electrical Engineering Chairman Search Committee (Fall 1992-Fall 1993)
9. Secretary, Faculty Search Committee (Spring 1992)
8. Chairman, Graduate Policy Committee (Fall 1989-Fall 1993), member (1985-1986)
7. Member, Budget Committee (Fall 1991 -Fall 1993)
6. Chairman, Faculty Search Committee (academic year 1991-1992)
5. Organizer, Ph.D. Qualifying Exams (1985-1987)
4. Chairman, Broward Teaching Committee (1 986-1988)
3. Member, Equipment Committee (1984/1985,1988)
2. Member, Ph.D. in Electrical Engineering Planning Committee (1984)
1. Member, Undergraduate Curriculum Committee (1984)

6.4.5 Student Advising

2. FAU Bioengineering MS Degree Faculty Advisor, Member of Admissions Committee and Academic Program Coordinator (Spring 2007 – Present)
1. FAU Bioengineering Certificate Advisor (Fall 2003 – Present)

6.5. Principal Consultancies

1. Sankyo Robotics, Boca Raton, Florida (1997-1998)
2. Scientific Instruments, Inc., Riviera Beach, Florida (2001-2007)

6.6. Technical Service

1. Co-organizer of the Fifth Annual Conference on Recent Advances in Robotics, Florida Atlantic University, June 1992.
2. Co-organizer of the Fourth Annual Conference on Recent Advances in Robotics, Florida Atlantic University, May 1991.
3. Co-organizer of the Third Annual Conference on Recent Advances in Robotics, Florida Atlantic University, May 1990.
4. Co-organizer of the Second Annual Conference on Recent Advances in Robotics, Florida Atlantic University, May 1989.
5. Organizer and Chairman of the First Annual Conference on Recent Advances in Robotics, Florida Atlantic University, May 1988.
6. Organizer of 9 one-day Robotics Workshops, Florida Atlantic University (1986-1989)
7. Member, Organizing Committee, PROCIM'88.
8. Reviewer for (papers, book manuscripts, research proposals):

1. IEEE Transactions on Robotics and Automation (4-5 papers/year)
 2. IEEE Transactions on Information Theory
 3. IEEE Transactions on Automatic Control
 4. ASME Journal of Mechanisms, Transmission and Automation in Design
 5. ASME Journal of Dynamic Systems, Measurement and Control (3-4 papers year)
 6. Mechanism and Machine Theory
 7. ASCE Journal of Engineering Mechanics
 8. CRC Press, Inc.
 9. 1989, 1990 and 1991 IEEE International Conference on Robotics and Automation
 10. Springer-Verlag -- New York Publishers
 11. Holt, Rinehart & Winston, Inc., New York
 12. Prentice Hall, Inc., Englewood Cliffs, N. J.
 13. Automatica
 14. IEEE Control Systems Magazine
 15. Journal of Robotic Systems
 16. American Control Conferences 1989 and 1990
 17. 1992 IEEE Decision and Control Conference
 18. Transactions of NAM RC
 19. The Israel Science Foundation
 20. The Florida-Israel Institute
 21. National Science Foundation
9. Session Chairman, Joint Conference on "Recent Developments in Solid Mechanics" September 11, 1992, Florida Atlantic University.
 10. Member of the international Program Committee, Manufacturing Program, International Symposium on Robotics and Manufacturing, ISRAM'94, August 14-18, 1994, Maui, Hawaii.
 11. Organizer and co-chair of the 2000 Florida Recent Advances in Robotics Conference, Florida Atlantic University, SeaTech, Dania Florida, May 4-5 2000.
 12. Organizer and co-chair of a special session on Robotics Education in WAC 2002, Orlando Florida.
 13. Organizer and co-chair of the 16th Florida Conference on Recent Advances in Robotics (FCRAR 2003), SeaTech, Florida Atlantic University, May 8-9, 2003.
 14. Member of the Organizing Committee FCRAR 2004, Florida Conference on Recent Advances in Robotics, May 6-7 2004, University of Central Florida, Orlando Florida.
 15. Member of the Organizing Committee FCRAR 2005, Florida Conference on Recent Advances in Robotics, May 5-6 2005, University of Florida, Gainesville Florida.
 16. Organizer and co-Chair of FCRAR 2009, Florida Atlantic University, May 2009.
 17. Member of the Organizing Committee FCRAR 2010, Florida Conference on Recent Advances in Robotics, May 2010, University of North Florida, Jacksonville Florida.

18. Member of the Organizing Committee FCRAR 2010, Florida Conference on Recent Advances in Robotics, May 2010, University of North Florida, Jacksonville Florida.
19. Organizer and Chair FCRAR 2012, Florida Conference on Recent Advances in Robotics, May 2012, FAU, Boca Raton, FL
20. Member of the Organizing Committee FCRAR 2014, Florida Conference on Recent Advances in Robotics, May 2014, FIU, Miami FL.
21. Reviewer for the Measurements Science and Technology journal, 2010-Present (3-4 papers a year)
22. Reviewer for Frontiers of Information Technology & Electronic Engineering, 2015.
23. Co-Organizer and Co-Chair (with Dr. Oren Masory) of FCRAR 2017, Florida Conference on Recent Advances in Robotics, May 2017, FAU, Boca Raton, FL.
24. Reviewer for SummerSim, 2017.

7. Professional Recognition

1. Senior Member of the IEEE (Conferred - February 1992); Inactive IEEE membership
2. Nominated by the FAU College of Engineering for the Florida Atlantic University Research Award, Spring 1993.
3. Associate Editor, International Journal of Intelligent Automation and Soft Computing. (1995-1996)
4. Eminent Engineer, Tau Beta Pi, Epsilon Chapter, Palm Beach, Florida. (Enacted 11/18/94); Inactive member
5. Member of Sigma Xi (since April 1995); Inactive member
6. PE State of Florida; Inactive member