

H. HARRY ASADA

FORD PROFESSOR OF ENGINEERING AND DIRECTOR

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Professor H. Harry Asada is Ford Professor of Engineering and Director of the Brit and Alex d'Arbeloff Laboratory for Information Systems and Technology in the Department of Mechanical Engineering at the Massachusetts Institute of Technology. He earned his B.S. degree in Mechanical Engineering, and M.S. and Ph.D. degrees in Precision Engineering in 1973, 1975, and 1979, respectively, all from Kyoto University, Japan. He joined the M.I.T. faculty in 1982. Professor Asada teaches and conducts research in the area of robotics, bioengineering, and dynamic systems and control.

Professor Asada's research programs have focused on the design, system dynamics, and control of robotic, biomedical, and biological systems. He invented Direct-Drive Robots in 1981, which have been used worldwide for clean-room automation and assembly. His theory of inertial decoupling and inertia ellipsoids reduces complexity of robot dynamics and control. He pioneered robotics research on grasping and fixturing in late 70s and early 80s through the development of grasp stability and fixturing theory. He has also made critical contributions to robot control and teaching through seminal works on skill acquisition, contact state network, and compliance synthesis. He has developed a number of innovative devices for robotics and biomedical applications, including fingernail sensors for measuring fingertip forces and finger posture without covering the fingertips; holonomic ball-wheel vehicles for omni-directional wheelchairs; the MIT Ring wearable sensor for continuous health monitoring; and cellular muscle actuators. His research interest has recently been extended to bio-integrated robotics, with a specific goal of building robots and biomedical devices using live cells as components. His research group has been developing skeletal muscle actuators controlled by optical stimuli, while conducting basic research on angiogenesis, cell migration, and emergent behaviors of cellular systems.

Professor Asada has published 3 books, 120 archival journal papers and 369 refereed conference proceedings papers, and holds 25 US patents. He has mentored 72 Master's students and 43 Doctoral students as well as several Postdoctoral Associates, now pursuing successful careers in industry, research laboratories, and academia including faculty positions at Massachusetts Institute of Technology, Georgia Tech, University of Utah, university of Maryland, Concordia University, Seoul National University, Yonsei University, Ritsumeikan University, and Australian National University.

Professor Asada has been the recipient of several awards and honors recognizing his research and teaching efforts, including the ASME Rufus Oldenburger Medal, the Spira Award for Distinguished Teaching, the Henry Paynter Outstanding Researcher Award, and Fellow of the American Society of Mechanical Engineers. He has also received 12 best paper awards, including the O. Hugo Schuck Best Paper Award from the American Control

Council in 1985, Best Paper Awards at the IEEE International Conference on Robotics and Automation in 1993, 1997, 1999, and 2010, and Best Journal Paper Awards from the Society of Instrument and Control Engineers in 1979, 1984, and 1990.



Formal



Casual

H. Harry Asada

FORD PROFESSOR OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING
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Education:

Ph.D	Kyoto University, Precision Engineering	1979
M.S.	Kyoto University, Precision Engineering	1975
S.B.	Kyoto University, Mechanical Engineering	1973

Selected MIT Appointments and Service:

Joined the MIT Faculty	1982
Ford Professor of Engineering	1996 - present
Director, d'Arbeloff Laboratory for Information Systems and Technology	1995 - present
Professor of Mechanical Engineering	1990 - Present
Mechanical Engineering Strategic Planning Committees, 1997 - 1998, 2004 - 2005, 2011	
Head, Area 3 Control, Instrumentation, and Robotics, ME Dept.	2005 - 2007 and 2010 - present

Selected Honors and Awards:

Best Journal Paper Awards, Society of Instrument and Control Engineers	1979, 1984, and 1990
SME Outstanding Young Manufacturing Engineer Award	1984
O. Hugo Schuck Best Paper Award, American Control Council	1985
Sawaragi Best Paper Award, Japanese Associate of Automatic Control Engineers	1988
Best Conference Paper Awards, IEEE International Conference on Robotics and Automation	1993 and 1999
Best Paper Award, 1995 ASME Heat Pump Symposium	1995
Kayamori Best Paper Award, Automation Theory and Application, IEEE International Conference on Robotics and Automation,	1997
Henry Paynter Outstanding Researcher Award, ASME Dynamic Systems and Control Division	1998,
ASME Fellow, Dynamic Systems and Control Division	2001
Best Journal Paper Award, Advanced Robotics, Robotics Society of Japan	2002
Best Automation Paper Award, 2010 IEEE Int. Conf. on Robotics and Automation, 2010	
Best Paper Award, 2010 IFAC Symposium on Mechatronic Systems, September	2010
Rufus Oldenburger Medal, American Society of Mechanical Engineers,	2011
Spira Award for Distinguished Teaching, MIT School of Engineering	2011

Selected External Professional Service

Advisory Board, National Science Foundation, Robotics and Human Augmentation	1994
Visiting Committee, National Science Foundation, Civil and Mechanical Systems Department	2003
Chair, Honors and Awards Committee, ASME DSC Division,	2005
External Board, University of Pennsylvania, Department of Mechanical Engineering and Applied Mechanics	2007
Strategic Planning Committee, ASME Dynamic Systems and Control Division,	2008
General Chair, 2012 ASME Dynamic Systems and Control Conference,	2011 - 2012

Publications of H. Harry Asada

Professor Asada has published 3 books, 119 peer-reviewed archival journal papers; 369 refereed conference proceedings papers, and is an inventor of 25 U.S. Patents. Professor Asada has mentored 72 S.M. and 43 Ph.D. students as well as several postdoctoral associates. A list of Archival Refereed Journal Articles is provided below in chronological order:

1. Hanafusa, H., and Asada, H., "Position Searching by a Robotic Hand with Pneumatic Sensors", *Trans. Soc. Instrument and Control Engineers*, Vol. 11-5, pp. 592-599, 1975.
2. Hanafusa, H., and Asada, H., "Mechanics of Grasping by Artificial Fingers", *Trans. Soc. Instrument and Control Engineers*, Vol. 12-5, pp. 536-542, 1976. Received the Best Journal Paper Award in 1979.
3. Hanafusa, H., and Asada, H., "Stable Prehension of Objects by Robotic Hands with Elastic Fingers", *Trans. Soc. Instrument and Control Engineers*, Vol. 13-4, pp. 370-377, 1977.
4. Hanafusa, H., and Asada, H., "Analysis of Prehension Characteristics of Robot Hand Control Systems with Elastic Fingers and Its Synthesis", *Trans. Soc. Instrument and Control Engineers*, Vol. 13-6, pp. 587-594, 1977.
5. Hanafusa, H., and Asada, H., "Handling of Constrained Objects by Active Elastic Fingers and Its Applications to Assembly", *Trans. Soc. Instrument and Control Engineers*, Vol. 15-1, pp. 61-66, 1979.
6. Asada, H., and Hanafusa, H., "Playback Control of Force Teachable Robots", *Trans. Soc. Instrument and Control Engineers*, Vol. 15-3, pp. 410-411, 1979.
7. Asada, H., and Hanafusa, H., "Prehension and Handling of Objects by Robotic Hands with Redundant Fingers", *Trans. Soc. Instrument and Control Engineers*, Vol. 15-5, pp. 666-671, 1979.
8. Asano, S., Asada, H., and Hanafusa, H., "Design of Elastic Robot Hands for Precision Inserting Operations", *Systems and Control*, Vol. 24-3, pp. 201-208, 1980.
9. Asada, H., and Hanafusa, H., "Spatial Curve Tracing Control of Industrial Robots", *Trans. Soc. Instrument and Control Engineers*, Vol. 16-5, pp. 740-746, 1980.
10. Asada, H., "Development of a Direct-Drive Robot and Evaluation of Its Control Performance", *Trans. Soc. Instrument and Control Engineers*, Vol. 19-1, pp. 77-84, 1983.

11. Asada, H., and Kanade, T., "Design of a Direct-Drive Mechanical Arms", ASME Journal of Vibration, Stress, and Reliability in Design, Vol. 105-3, pp. 312-316, July 1983.
12. Asada, H., "A Geometrical Analysis of Manipulator Dynamics", Trans. Soc. Instrument and Control Engineers, Vol. 19-6, pp. 500-505, 1983. Received the Best Journal Paper Award in 1984.
13. Asada, H., Kanade, T., and Takeyama, I., "Control of a Direct-Drive Arm", ASME J. of Dynamic Systems, Measurement, and Control, Vol. 105-3, pp. 136-142, September 1983.
14. Asada, H. "A Geometrical Representation of Manipulator Dynamics and Its Application to Arm Design", ASME J. Dynamic Systems, Measurement, and Control, Vol. 105-3, pp. 131-142, September 1983.
15. Asada, H., and Youcef-Toumi, K., "Analysis and Design of a Direct-Drive Arm with Five-Bar-Link Parallel Drive Mechanism", ASME J. Dynamic Systems, Measurement, and Control, Vol. 106-3, pp. 225-230. September 1984.
16. Asada, H., and By, A.B., "Kinematic Analysis of Workpart Fixturing for Flexible Assembly with Automatically Reconfigurable Fixtures", IEEE Journal of Robotics and Automation, Vol. RA-1, No. 2, pp. 1-9, June 1985.
17. Asada, H., and Ro, I. H., "A Linkage Design for Direct-Drive Robot Arms", ASME J. Mechanisms, Transmissions and Automation in Design, Vol. 107, Issue 4, pp. 536-540, 1985.
18. Asada, H., and Sawada, Y., "Design of an Adaptable Tool Guide for Grinding Robots", Int. J. Robotics and Computer-Integrated Manufacturing, Vol. 2, Issue 1, pp. 49-54, 1985.
19. Asada, H., "Basic Concepts and Applications of Programmable Jigs, and Fixtures Assembled by a Robot", J. Robotics Society of Japan, Vol. 4-4, pp. 374-381, 1986.
20. Asada, H., "Measurement and Control of Joint Torques for Direct-Drive Arms", Trans. Soc. Instrument and Control Engineers, Vol. 22-8, pp. 891-896, 1986.
21. Otsuki, H., and Asada, H., "Error Estimation of Workpart Locations for Curved Surface Contouring", Trans. Soc. Instrument and Control Engineers, Vol. 22-10, pp. 1121-1123, 1986.
22. Asada, H., "Theory of Manipulator Arm Design for Decoupled and Invariant Inertia", Trans. Soc. Instrument and Control Engineers, Vol. 23-2, pp. 155-162, 1987.

23. Youcef-Toumi, K., and Asada, H., "The Design of Open Loop Manipulator Arms with Decoupled and Configuration-Invariant Inertia Tensors", *ASME J. Dynamic Systems, Measurement, and Control*, Vol. 109, Issue 3, pp. 268-275, September 1987.
24. Asada, H., and Ogawa, K., "Dynamic Analysis of Robotic Arms Using Inverse Inertia Matrices and Its Applications to Task Planning and End-Effector Design", *Trans. Soc. Instrument and Control Engineers*, Vol. 24-9, 1987.
25. Ma, Z.-D., Asada, H., and Tokumaru, H., "Inverse Dynamics of Flexible Robot Arms for Trajectory Control", *Trans. Systems and Control*, Vol. 31-10, 1987. Received the Sawaragi Best Paper Award in 1988
26. Asada, H., and Izumi, H., "Teaching and Program Generation for Hybrid Position/Force Control Via the Measurement of Human Manipulation Tasks", *J. Robotics Society of Japan*, Vol. 5-6, pp. 452-459, 1987.
27. Hirai, S., Asada, H., and Tokumaru, H., "Kinematic Analysis of Contact State Transitions in Assembly Operations and Automatic Generation of Transition Network", *Trans. Society of Instrument and Control Engineers*, Vol. 24-4, pp. 406-413, 1988. Received the Best Journal Paper Award in 1990.
28. Asada, H., and Asari, Y., "The Identification of Tool Suspension Impedance Via the Measurement of Expert Motion and Its Application to Robot Teaching", *Trans. Society of Instrument and Control Engineers*, Vol. 24-12, 1988.
29. Hirai, S., H., and, Asada H., and Tokumaru, H., "Kinematics of Manipulation Using the Theory of Polyhedral Convex Cones and Its Applications to Grasping and Assembly Operations", *Trans. Society of Instrument and Control Engineers*, Vol. 24-12, 1988.
30. Asada, H., and Izumi, H., "Automatic Program Generation from Teaching Data for the Hybrid Control of Robots", *IEEE Journal of Robotics and Automation*, Vol. 5, No. 2, pp. 166-173, April 1989.
31. Asada, H., and Kitagawa, M., "Kinematic Analysis and Planning for Form Closure Grasps by Robotic Hands", *Int. J. Robotics and Computer-Integrated Manufacturing*, Vol. 5, No. 4, pp. 293-299, 1989.
32. Fields, A., Youcef-Toumi, K., and Asada, H., "Flexible Fixturing and Automatic Drilling of Sheet- Metal Parts Using a Robot Manipulator", *Int. J. Robotics and Computer-Integrated Manufacturing*, Vol. 5, No. 4, pp. 371-380, 1989.
33. Asada, H., and Kim, Y.T., "Dynamic Compliance Control of Direct-Drive Robots with Built-In Optical Torque Sensors", *Journal of the Robotics Society of Japan*, Vol. 7-4, 1989.

34. Ma, Z.-D., Asada, H., and Tokumaru, H., "On the Simplification of Flexible Arm Dynamics and Their Solutions to the Inverse Dynamics Problem", *Transaction of the Society of Instrument and Control Engineers*, Vol. 25, No.4, pp. 440-447, 1989.
35. Ma, Z.-D., Asada, H., and Tokumaru, H., "Existence of Feasible Solutions to the Inverse Dynamics of Flexible Robot Arms and Guidelines for Designing Arm Links", *Transaction of the Society of Instrument and Control Engineers*, Vol. 25, No.3, pp. 325-332, 1989.
36. Asada, H., Ma, Z.-D., and Tokumaru, H., "Inverse Dynamics of Flexible Robot Arms: Modeling and Computation for Trajectory Control", *ASME J. Dynamic Systems, Measurement, and Control*, Vol. 112, Issue 2, pp. 177-185, June 1990.
37. Asada, H., and Kakumoto, Y., "The Dynamic Analysis and Design of a High-Speed Insertion Hand Using the Generalized Centroid and Virtual Mass", *ASME Journal of Dynamic Systems, Measurement, and Control*, Vol. 112, Issue 4, pp. 646-654, December 1990.
38. Asada, H., and Yang, B.H., "Skill Acquisition from Human Experts Through Pattern Processing of Teaching Data", *Journal of the Robotics Society of Japan*, Vol. 8, No. 1, pp. 17-24, 1990.
39. Hirai, S., Asada, H., and Tokumaru, H., "A Model-Based Approach to the Interpretation of Force and Position Sensor Signals for the Process Monitoring of Assembly Operations", *Trans. of Soc. of Instrument and Control Engineers*, Vol., 26, No. 2, pp. 225-232, 1990.
40. Liu, S., and Asada, H., "Transferring Manipulative Skills to Robots: Representation and Acquisition of Tool Manipulative Skills Using a Process Dynamics Model", *ASME J. Dynamic Systems, Measurement and Control*, Vol. 114, Issue 2, pp. 220-228 June 1992.
41. McCarragher, B.J., and Asada, H., "Qualitative Template Matching Using Dynamic Process Models for State Transition Recognition of Robotic Assembly", *ASME Journal of Dynamic Systems, Measurement, and Control*, Vol. 115, Issue 2(A), pp. 261-269, June 1993.
42. Asada, H., Federspiel, C.C., and Liu, S., "Human Centered Control in Robotics and Consumer Product Design", *ASME Journal of Dynamic Systems, Measurement, and Control*, Vol. 115, Issue 2B, pp. 271-280, June 1993.
43. Asada, H., "Representation and Learning of Nonlinear Compliance Using Neural Nets", *IEEE Transaction on Robotics and Automation*, Vol. 9, No. 6, pp. 863-867, December 1993.

44. Hirai, S., and Asada, H., "Kinematics and Statics of Manipulation Using the Theory of Polyhedral Convex Cones", *The International Journal of Robotics Research*, vol. 12, No. 5, PP. 434-447, October 1993.
45. Park, J.-H., and Asada, H., "Dynamic Analysis of Noncollocated Flexible Arms and Design of Torque Transmission Mechanisms", *ASME J. Dynamic Systems, Measurement, and Control*, Vol. 116, June 1994.
46. Park, JH., and Asada, H., "Concurrent Design Optimization of Mechanical Structure and Control for High Speed Robots", *ASME Journal of Dynamic Systems, Measurement, and Control*, Vol. 116, Issue 3, pp. 344-356, September 1994.
47. Fedespiel, C.C., and Asada, H., "User Adaptable Comfort Control of HVAC System", *ASME Journal of Dynamics Systems, Measurement and Control*, Vol. 116, Issue 3, pp. 474-486, September 1994.
48. Rai, S., and Asada, H., "Computer-Aided Structure Modification of Electromechanical Systems Using Singular Value Decomposition", *ASME Journal of Mechanical Design*, Vol. 116, Issue 4, pp. 1148-1156, December 1994.
49. Nishikawa, K., West, A.M., and Asada, H., "Development of a Holonomic Omnidirectional Vehicle and an Accurate Guidance Method for Vehicles", *Journal of Robotics Society of Japan*, Vol. 13, No. 2, pp. 249-256, 1995.
50. Asada, H., Asari, Y., "The Direct Teaching of Tool Manipulation skills Via the Impedance Identification of Human Motions", *Journal of Robotics Society of Japan*, Vol. 13, 1995.
51. Yang, B-H., and Asada, H., "Adaptive Reinforcement Learning and Its Application to Compliance Control", *Journal of Robotics and Mechatronics*, Vol. 7, No. 3, 1995.
52. West, A.M., and Asada, H., "Design of Ball Wheel Mechanisms for Omnidirectional Vehicles with Full Mobility and Invariant Kinematics", *ASME Journal of Mechanical Design*, Vol.119, Issue 2, pp. 153-161, June 1997.
53. Rai, S., and Asada, H., "Integrated Structure/Control Design of High Speed Flexible Robots Based on Time Optimal Control", *ASME Journal of Dynamic Systems, Measurement and Control*, Vol. 117, Issue 4, pp. 503-512, December 1995.
54. McCarragher, B.J. and Asada, H., "The Discrete Event Modeling and Trajectory Planning of Robotic Assembly", *ASME, Journal of Dynamic Systems, Measurement and Control*, Vol. 117, Issue 3, pp. 394-400, September 1995.
55. McCarragher, B.J. and Asada, H., "The Discrete Event Control of Robotic Assembly Tasks", *ASME, Journal of Dynamic Systems, Measurement and Control*, Vol. 117, Issue 3, pp. 384-393, September 1995.

56. Pil, A. and Asada, H., "Rapid Recursive Structure Re-Design for Improved Dynamic Performance", ASME Journal of Dynamic Systems, Measurement and Control, July 1994, Vol. 117, December 1995.
57. Yang, B.-H. and Asada, H., "Progressive Learning and Its Application to Robot Impedance Learning", IEEE Transaction on Neural Networks, Vol. 7, Issue 4, pp. 941-952, July 1996.
58. Liu, S. and Asada, H. "Teaching Human Motion/Force Skills to Robots", Journal of Robotics Society of Japan, Vol. 13, No. 5, pp. 10-16, July 1996.
59. Pil, A.C., and Asada, H., "Integrated Structure/Control Design of Mechatronic Systems using a recursive experimental optimization method", IEEE/ASME Transactions on Mechatronics, Vol. 1, Issue 3, pp 191-203, September 1996.
60. Shimokura, K. Asada, H. and Liu, S., "A Study of Human Skill Transfer for Teaching a Deburring Robot", Journal of Robotics Society of Japan, Vol. 14, No. 1, pp. 144-149, January 1996.
61. He, X-D., Liu,S. and Asada, H. "Modeling of Vapor Compression Cycles for Multivariable Feedback Control of HVAC Systems", ASME Journal of Dynamic Systems, Measurement, and Control, Vol.119, Issue 2, pp.183-191, June 1997.
62. Braunstein, D., and Asada, H., "On-line Estimation of Power Law Fluid Parameter for Solder Paste Printing Control", Accepted for publication in ASME Journal of Electronic Packaging.
63. Ravuri, M. and Asada H., 1997 "Asymmetric Order Doubling with Application to the Endpoint Feedback of Coordinate Measuring Machines", IEEE/ASME Transactions of Mechatronics.
64. He, X.-D., Liu, S., Asada, H., and Itoh, H., "Multivariable Control of Vapor Compression Systems", ASHREA Journal of Heating, Ventilation, Airconditioning, and Refrigerating (HVAC&R) Research, Vol. 4, No. 3, pp. 205-230, July 1998.
65. Zhou, M., Liu, S., and Asada, H., "Zero-Load Control of Indoor Thermal Environment", ASHRAE Transactions, Vol. 104, Number 1, Section A, pages 752-758, January 1998.
66. Yang, B-H. Wada, M., and Asada, H., "Human-Centered Control and Its Application to Home Healthcare Systems," Journal of Robotics Society of Japan, Vol. 16, No.3, pp. 19-23, April 1998.
67. Wada, M., and Asada, H., "A Holonomic Omnidirectional Vehicle With a Reconfigurable Footprint Mechanism and Its Application to a Wheelchair", Journal of Robotics Society of Japan, Vol. 16, No.6, pp. 82-89, September 1998.

68. Sooyong, Lee, and Asada, H., "A Perturbation/Correlation Method for Force Guided Robot Assembly", IEEE Transactions on Robotics and Automation, Vol.15, Issue 4, pp.764-773, August 1999.
69. Wada, M., and Asada, H., "Design and Control of a Variable Footprint Mechanism for Holonomic Omnidirectional Vehicles and Its Application to Wheelchair", IEEE Transactions on Robotics and Automation, Vol.15, Issue 6, pp. 978-989, December 1999.
70. Spano, J., and Asada, H., "Kinematic Analysis and Design of Surface Wave Distributed Actuators with Application to a Powered Bed for Bedridden Patients", IEEE Transactions on Robotics and Automation, Vol.16, Issue 1, pp. 1-11, February 2000.
71. Gordon, B.W., Liu, S., and Asada, H., "Singularly Perturbed Sliding Manifolds for Modeling and Realization of Differential-Algebraic Systems", International Journal of Control.
72. Spano, J., and Asada, H., "Design of Surface Wave Active Beds Based on Human Tissue Physiology", Advanced Robotics, International Journal of the Robotics Society of Japan, Vol. 14, No. 8, pp. 717-742, 2001. Received the Best Journal Paper Award
73. Gordon, B.W., and Asada, H., "Modeling, Realization, and Simulation of Thermo-Fluid Systems Using Singularly Perturbed Sliding Manifolds", ASME Journal of Dynamic Systems, Measurement, and Control, Vol. 122, No. 4, pp. 699-707, December 2000.
74. Mascaro, S. and Asada, H., "Photoplethysmograph Fingernail Sensors for Measuring Finger Forces without Haptic Obstruction," IEEE Transactions on Robotics and Automation, vol. 17, Issue 5, pp. 698-708, October 2001.
75. Rhee, S-W., Yang, B-H, and Asada, H., "Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors", IEEE Transactions on Biomedical Engineering, Vol.48, Issue 7, pp.795-805, July 2001.
76. Shaltis, P.A., Asada, H., and Rhee, S., "Artifact-Resistant, Power-Efficient, High Speed Modulation Design for Photo Plethysmographic Ring Sensors," Annals of Biomedical Engineering, Vol. 29, Supplement 1, (S-117), 2001.
77. Tahboub, K. A., and Asada, H., "Dynamic Analysis and Control of a Holonomic Vehicle with a Continuously Variable Transmission", ASME Journal of Dynamic Systems, Measurement, and Control, Vol. 124, Issue 1, pp.118-126, March 2002.
78. Mascaro, S. and Asada, H., "Measurement of Finger Posture and Three-Axis Fingertip Touch Force Using Fingernail Sensors", IEEE Transactions on Robotics and Automation, Vol. 20, Issue 1, pp. 26-35, February 2004.

79. Asada, H, Shaltis P, Reisner A, Rhee S, and Hutchinson, RC., "Mobile Monitoring with Wearable Photoplethysmographic Biosensors", IEEE Engineering in Medicine and Biology Magazine, Vol.22, No.3, pp. 28-40, May-June 2003.
80. Gu, B. and Asada, H., "Co-Simulation of Algebraically Coupled Dynamic Subsystems without Disclosure of Proprietary Subsystem Models", ASME Journal of Dynamic Systems, Measurement, and Control, Vol.126, No.1, pp. 1-13, March 2004.
81. Zhang, Y. and Asada, H., "Blind System Identification of Noncoprime Multichannel Systems and Its Application to Noninvasive Cardiovascular Monitoring", ASME Journal of Dynamic Systems, Measurement, and Control, Vol.126, No.4, pp. 834-847, December 2004.
82. He, X-D., Chen, T., Kasahara, S. and Asada, H., "An Oil Circulation Observer for Estimating Oil Concentration and Oil Amount in Refrigerant Compressors", ASHRAE Transaction, Vol. 110, Part 2, pp. 489-498, 2004.
83. Roy, B., Basmajian, A., and Asada, H., "Repositioning of a Rigid Body with a Flexible Sheet and its Application to an Automated Rehabilitation Bed", IEEE Transactions on Automation Science and Engineering, Vol.2, Issue 3, pp.300 – 307, July 2005.
84. Gibbs, T., and Asada, H., "Wearable Conductive Fiber Sensors for Multi-Axis Human Joint Angle Measurements", Journal of Neuroengineering and Rehabilitation, 2:7, March 2, 2005. Special Issue on Wearable Technology in Rehabilitation, February, 2005.
85. McCombie, D., Reisner, A., and Asada, H., "Laguerre Model Blind System Identification: Cardiovascular Dynamics Estimated from Multiple Peripheral Circulatory Signals", IEEE Transactions on Biomedical Engineering, Vol. 52, No. 11, pp. 1889 – 1901, November 2005.
86. Odhner, L., and Asada, H., "Sensorless Temperature Estimation and Control of Shape Memory Alloy Actuators Using Thermoelectric Devices", IEEE/ASME Transactions on Mechatronics, Vol. 11, Issue 2, pp.139-144, April 2006.
87. Selden, B., Cho, K.-J., and Asada, H., "Segmented Shape Memory Alloy Actuators Using Hysteresis Loop Control", Smart Materials and Structures, Vol.15, No.2, pp.642-652, March 2006.
88. Cho, K.-J., and Asada, H., "Architecture Design of a Multi-Axis Cellular Actuator Array Using Segmented Binary Control of Shape Memory Alloy", IEEE Transactions on Robotics, Vol. 22, Issue 4, pp.831-843, August 2006.
89. Wade, E., and Asada, H., "Design of a Broadcasting Modem for a DC PLC Scheme", IEEE-ASME transactions on Mechatronics, Volume 11, Issue 5, Pages 533-540, October 2006.

90. Mascaro, S. and Asada, H., "The Common Patterns of Blood Perfusion in the Fingernail Bed Subject to Fingertip Touch Force and Finger Posture," *Haptics-e: The Electronic Journal of Haptics Research*, Vol. 4, No. 3, pp. 1-6, July 21, 2006.
91. Wade, E., and Asada, H., "Conductive Fabric Garment for a Cable-Free Body Area Network: Conductivity Analysis for DC Power-Line Communication over Fabric Media", *IEEE Transactions on Pervasive Computing*, Vol. 6, Issue 1, page 52-58, January – March 2007. (Special issue on pervasive computing in health care, December 2006.)
92. Reisner, A., Shaltis, P., McCombie, D., and Asada, H., "Utility of the Photoplethysmogram in Circulatory Monitoring", *The Journal of the American Society of Anesthesiologists, Inc.*, Vol. 108, Issue 5, pp 950-958, May 2008.
93. Ueda, J., Odhner, L. and Asada, H., "Broadcast Feedback of Stochastic Cellular Actuators Inspired by Biological Muscle Control", *The International Journal of Robotics Research*, Vol. 26, No.11-12, pp.1251-1265, November 2007.
94. Shaltis, P., Reisner, A., and Asada, H., "Cuffless Blood Pressure Monitoring Using Hydrostatic Pressure Challenges", *IEEE Transactions on Biomedical Engineering*, Vol. 55, Issue 6, pp. 1775 – 1777, June 2008.
95. Hahn, J.-O., McCombie, D., Hojman, H., Reisner, A., and Asada, H., "Identification of Multi-Channel Cardiovascular Dynamics Using Dual Laguerre Basis Functions for Noninvasive Cardiovascular Monitoring", *IEEE Transactions on Control Systems Technology*, Vol. 18, Issue 1, pp. 170-176, January 2010.
96. Roy, B., and Asada, H., "Non-linear Feedback Control of a Gravity-assisted Underactuated Manipulator with Application to Aircraft Assembly", *IEEE Transactions on Robotics*, Vol. 25, Issue 5, pp. 1125-1133, October 2009.
97. Hahn, J.-O., Reisner, A., and Asada, H., "Blind Identification of 2-Channel IIR Systems with Application to Central Cardiovascular Monitoring", *ASME Journal of Dynamic Systems, Measurement, and Control*, Vol. 131, No 5, 2009.
98. Wood, L., Das, A., Kamm, R. and Asada, H., "A Stochastic Broadcast Feedback Approach to Regulating Cell Population Morphology for Microfluidic Angiogenesis Platforms", *IEEE Transactions on Biomedical Engineering*, Vol.56, Issue 9, Part 2, pp.2299-2303, September, 2009.
99. Hahn, J.-O., Reisner, A., and Asada, H., "Modeling and 2-Sensor Blind Identification of Human Cardiovascular System", *Control Engineering Practice*, Vol. 17, Issue 11, pp. 1318-1328, November 2009.

100. Odhner, L., and Asada, H., "Stochastic Recruitment Control of Large Ensemble Systems with Limited Feedback", ASME Journal of Dynamic Systems, Measurement, and Control, Vol. 132, Issue 4, 041008 (9 pages), September 2009.
101. Mazumdar, A., and Asada H., "An Under-actuated, Magnetic-Foot Robot for Steel Bridge Inspection", ASME journal of Mechanisms and Robotics, vol.2, Issue 3, August 2010.
102. Das, A., Lauffenburger, D., Asada, H., and Kamm, R., "A Hybrid Continuum–Discrete Modeling Approach to Predict and Control Angiogenesis: Analysis of Combinatorial Growth Factor and Matrix Effects on Vessel-Sprouting Morphology", Philosophical Transactions of the Royal Society A: Mathematical, Physical, and Engineering Sciences, vol. 368, no. 1921, pp. 2937-2960, June 2010.
103. Hahn, J.-O., Reisner, A., and Asada, H., "Estimation of Pulse Transit Time Using Two Diametric Blood Pressure Waveform Measurements", Medical Engineering & Physics, Vol. 32, Issue 7, pages 753-759, September 2010.
104. Secord, T., and Asada, H., "A Variable Stiffness PZT Actuator Having Tunable Resonant Frequencies", IEEE Transactions on Robotics, vol.26, no.6, pp.993-1005, Dec.2010.
105. Ueda, J., Secord, T and Asada, H, "Large Effective-Strain Piezoelectric Actuators Using Nested Cellular Architecture With Exponential Strain Amplification Mechanisms," IEEE/ASME Transactions on Mechatronics, vol.15, no.5, pp.770-782, Oct. 2010.
106. Wood, L., Kamm, R., and Asada, H., "Stochastic Modeling and Identification of Emergent Behaviors of an Endothelial Cell Population in Angiogenic Pattern Formation", Int. Journal of Robotics Research, Vol. 30 No. 6, pp. 659-677, May 2011.
107. Menon, M., and Asada, H., "Design and Control of Paired Mobile Robots Working Across a Thin Plate with Application to Aircraft Manufacturing", IEEE Transactions on Automation Science and Engineering, vol. 8, no. 3, pp. 614-624, July 2011.
108. Wood, L., and Asada, H., "Cellular Stochastic Control of the Collective Output of a Class of Distributed Hysteretic Systems", ASME J. of Dynamic Systems, Measurement, and Control, Vol. 133, Issue 6, pp. 61011- 61022, November 2011.
109. Hahn, J.-O., Reisner, A., Jaffer, F.A., and Asada, H., "Subject-Specific Estimation of Central Aortic Blood Pressure Using an individualized Transfer Function: a Preliminary feasibility Study", IEEE Transactions on Information Technology in Biomedicine, Issue 99, PMID: 22147332, November 2011.

110. Farahat, W., and Asada, H., "Estimation of State Transition Probabilities in Asynchronous Vector Markov Processes", Accepted for publication in the ASME J. of Dynamic Systems, Measurement, and Control, November 2011.
111. Hahn, J.-O., Reisner, A., Jaffer, F.A., and Asada, H., "Subject-Specific Estimation of Central Aortic Blood Pressure Using an individualized Transfer Function: a Preliminary feasibility Study", *IEEE Transactions on Information Technology in Biomedicine*, Issue 99, PMID: 22147332, Vol. 16, No. 2, pp. 212 – 220, March 2012.
112. Farahat, W., Wood, L., Zervantonakis, I., Schor, A., Ong, S., Neal, D., Kamm, R., and Asada, H., "Ensemble Analysis of Angiogenic Growth in Three-Dimensional Microfluidic Cell Cultures", *PLoS ONE*, Vol. 7, Issue 5, e37333, doi:10.1371/journal.pone.0037333, April 2012.
113. Ge, R., Tan, E., Sharghi-Namini, Soheila, Asada, H., "Exosomes in Cancer Microenvironment and Beyond: Have We Overlooked These Extracellular Messengers?", *Cancer Microenvironment*, Vol. 5, DOI 10.1007/s12307-012-0110-2, May 2012.
114. Kim, Choong, Chung, Seok, Liu, Yuchun, Kim, Min-Cheol, Chan, Jerry K. Y., Asada, H., and Kamm, D., "In Vitro Angiogenesis Assay for the Study of Cell-Encapsulation Therapy", in *Lab on a Chip*, DOI: 10.1039/C2LC40182G, May 2012.
115. Wood, L., Ge, R., Kamm, R., and Asada, H., "Nascent vessel elongation rate is inversely related to diameter in in vitro angiogenesis", *Integrative Biology*, DOI:10.1039/c2ib20054f, July 2012.
116. Neal, D., and Asada, H., "Bipolar Piezoelectric Buckling Actuators", accepted for publication in *ASME/IEEE Transactions on Mechatronics*, July 2012.
117. Sakar, M.S., Neal, D., Boudoub, T., Borochinb, M., Lic, Y., Weiss, R. Kamm, R.D., Chen, C. and Asada, H., "Formation and optogenetic control of engineered 3D skeletal muscle bioactuators", *Lab on a Chip*, 2012, Issue 23, pp. 4976-4985, DOI: 10.1039/C2LC40338B, October 2012, **Front Cover Article, Lab-on-a-Chip top 10%**.
118. Kim, M.-C., Kim, C., Wood, L., Neal, D., Kamm, R., and Asada, H., "Integrating Focal Adhesion Dynamics, Cytoskeleton Remodeling, and Actin Motor Activity for Predicting Cell Migration on 3D Curved Surfaces of Extracellular Matrix", *Integrative Biology*, 2012, DOI: 10.1039/C2IB20159C, September 2012
119. Mazumdar, A., and Asada, H., "Pulse Width Modulation of Water Jet Propulsion Systems Using High Speed Coanda-Effect Valves", *ASME Journal of Dynamic*

Systems, Measurement, and Control, Vol. 135(5), pp. 051019(1)- (11), September 2013.

120. Torres, J., Asada, H. H., “High-Gain, High Transmissibility PZT Displacement Amplification Using a Rolling-Contact Buckling Mechanism and Preload Compensation Springs,” (2013), accepted for publication in the *Transactions on Robotics*.
121. Ong, L.-L.S., Dauwels, J., Ang, M., and Asada, H., “A Bayesian Filtering Approach to Incorporate 2D/3D Time-lapse Confocal Images for Tracking Angiogenic Sprouting Cells Interacting with the Gel Matrix”, *Medical Image Analysis*, Vol. 18, Issue 1, pp. 211-227, January 2014.
122. Chan V., Asada H. H., and Bashir, R., "Utilization and control of bioactuators across multiple length scales," *Lab Chip*, 2014 (Advanced Article), DOI: 10.1039/C3LC50989C, **Front Cover Article, Lab on a Chip HOT article**, Issue 4, pp. 653-670, November 2013.
123. Ang, X.M., Lee, M.H.C., Blocki, A., Chen, C., Ong, L.L.S., Asada, H.H., Sheppard, A., and Raghunath, M., “Macromolecular crowding amplifies adipogenesis of human bone marrow-derived MSCs by enhancing the pro-adipogenic microenvironment”, *Tissue Engineering A*, doi: 10.1089/ten.TEA.2013.0337, 2013
124. Herath, S., Yue, D., Hui, S., Kim, M.C., Wang, D., Wang, Q., Van Vliet K.J., Asada, H.H., Chen, P., “Quantification of Magnetically Induced Changes in ECM Local Apparent Stiffness”, *Biophysical Journal*, Vol.106, Issue 1, pp.332-341, January 1, 2014.
125. Mazumdar, A., Asada, H., “Control-Configured Design of Spheroidal, Appendage-Free, Underwater Vehicles,” *Accepted for Publication in the IEEE Transactions on Robotics*, Dec. 2013.
126. Neal, D., and Asada, H., “Bipolar Piezoelectric Buckling Actuators”, *ASME/IEEE Transactions on Mechatronics*, Vol. 19, No. 1, pp. 9-19, February 2014.
127. Sharghi-Namini, S., Evan Tan E., Ong L.-L. S., Ge R., and Asada, H.H., “DII4-containing exosomes induce capillary sprout retraction in a 3D microenvironment”, Accepted for publication in *Nature, Scientific Reports*, January 2014