



[College of Science and Engineering](#) · [Department of Mechanical and Biomedical Engineering](#) | [MBE Academic Staff List](#)

Prof. SUN, Dong

Ph.D., Fellow of IEEE, Fellow of HKIE, P.Eng. (Canada), Member (ASME)

Head

Chair Professor of Biomedical Engineering

EMPLOYMENT

Chair Professor	City University of Hong Kong	Since 2013
Professor	City University of Hong Kong	2009 - 2013
Associate Professor	City University of Hong Kong	2005 - 2009
Assistant Professor	City University of Hong Kong	2000 - 2005
Post-doctoral Researcher	University of Toronto, Canada	1997 - 1999

EDUCATION

Ph.D. Robotics and Automation	Chinese University of Hong Kong
M.S. Precision Instrument and Biomedical Engineering	Tsinghua University, Beijing, China
B.Sc. Precision Instrument and Mechanology	Tsinghua University, Beijing, China

RESEARCH EXPERIENCE AND ACCOMPLISHMENT

Extensive research experiences in robotics and cell-based bioengineering, with numerous outcomes in both fundamental and applied researches. Obtain HK\$ 50M research funding and lead more than 30 research projects towards successful completion. Particular academic contributions include:

Leading researches in robotic single cell manipulation, focusing on development of cell manipulation tools with optical tweezers for probing cell functional mechanism. Make breakthrough researches in cell-based bioengineering at single cell level, developing table-top engineering solutions with integrated technologies in robotics & automation, optical tweezers, microfluidic chip and biomedical engineering.

Deep investigation in multiagent systems. Design, create and apply synchronization approaches and other multiagent approaches to multirobot coordination, CNC machining, robot formation networks and multi-cell manipulations.

Extensive researches in advanced robotics and mechatronics. Technology transfer and development of a high-tech start up in Hong Kong Science Park. Actively involved in collaboration research with industry in motion controls and automation product technologies.

Cell-based Bioengineering: Pioneered works on developing robot-aided cell manipulation system with optical tweezers. Cell manipulations include cell stretching, cell positioning, cell sorting and isolation, cell fusion and cell injection etc. Current studies focus on bioengineering solutions at single cell level to characterize nanobiomechanics property of biological cells, understanding cell mechanism and functional behaviors through researches in cell-to-cell interaction and cell migration control in micro-fluid channels. Currently lead one on-going CRF (Collaboration Research Fund) as Project Coordinator and participate one TRS (Theme-based Research Scheme) project and one CRF project as Co-PI.

Multirobot System: Creatively designed a cross-coupling synchronization control framework to control both position and synchronization errors to converge to zero. The research exhibited large potential in applications with multiagent and networked systems. The method has been applied to multirobot



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Research Interests

Robotics
 Cell-based bioengineering
 Motion control and Mechatronics

assembly, multiaxis motion control systems, CNC machining, parallel manipulators, and formation of multiple mobile robots.

Mechatronics and Motion Controls: Designed state-of-the-art motion control technologies for various robot control applications and mechatronics systems. Working with industry, led the applied research in developing innovative motion control product technology. The applied research outcome received numerous prestigious awards such as Hong Kong Awards for Industry, attracted industrial investment and government supports, and led to technology transfer.

PROFESSIONAL ACTIVITIES

Editorial board member of the new open-access journal IEEE Nanotechnology Express (since 2014)

Technical Editor of the IEEE/ASME Transactions on Mechatronics (2009-2013)

Associate Editor of the IEEE Transactions on Robotics (2004-2008)

Guest Editor, Asian Control Journal (2012, 2013)

Guest Editor, Sensors (2010, 2011)

Editor at large (2010-11) and Associate Editor (2008-2010) of the IEEE Robotics and Automation Society Conference Board

Adjunct Professor of University of Toronto, Canada

Guest Professor of University of Science and Technology, China

Member of Engineering Panel of Research Grant Council of Hong Kong (since 2011)

Program Co-Chair of 2014 IEEE/RSJ International Conference on Intelligent Robots and Systems

Program Chair of 2014 Hong Kong Biomedical Engineering Conference

General Chair of 2013 IEEE International Conference on Nanotechnology, Beijing, China

Program Co-Chair of 2013 IEEE International Conference on Advanced and Intelligent Mechanics (AIM)

Program Co-Chair of 2012 of International Conference on Control, Automation, Robotics and Vision

General Chair of 2010 IEEE International Conference on Nano/Molecular Medicine and Engineering

Program Chair of 2009 IEEE International Conference on Robotics and Biomimetics

SELECTED PUBLICATIONS

Books:

D. Sun, *Synchronization and Control of Multi-agent Systems*, CRC Press, Taylor & Francis Group, 2010.

Y. H. Liu, and **D. Sun**, *Biologically Inspired Robotics*, CRC Press, Taylor & Francis Group, 2011.

Articles:

1. H. Yang, X. Gou, Y. Wang, T. M Fahmy, A. Y. H. Leung, J. Lu, and **D. Sun**, "A dynamic model of chemoattractant induced cell migration," *Biophysical Journal*, vol. 108, no. 7, pp. 1645-1651, April 2015 (featured article).
2. X. Li, H. Yang, J. Wang, and **D. Sun**, "Design of a robust unified controller for cell manipulation with a robot-aided optical tweezers system," *Automatica*, vol. 55, no. 5, pp. 279-286, May 2015.
3. C. C. Cheah, X. Li, X. Yan, and **D. Sun**, "Simple PD control scheme for robotic manipulation of biological cell," *IEEE Trans. on Automatic Control*, vol. 60, no. 5, pp. 1427-1432, May 2015.
4. R. Zheng, Y. H. Liu, and **D. Sun**, "Enclosing a target by nonholonomic mobile robots with bearing-only measurements," *Automatica*, vol. 53, no. 3, pp. 400-407, March 2015.
5. R. Zheng, Z. Lin, M. Fu, and **D. Sun**, "Distributed control for uniform circumnavigation of ring-coupled unicycles," *Automatica*, vol. 53, no. 3, pp. 23-29, March 2015.
6. H. Chu, Z. Huan, J. K. Mills, J. Yang, and **D. Sun**, "Three-dimensional cell manipulation and patterning using dielectrophoresis via a multi-layer scaffold structure," *Lab on a Chip*, vol. 15, no. 3, pp. 920-930, February 2015.

7. X. Yan, and **D. Sun**, "Multilevel-based topology design and cell patterning with robotically controlled optical tweezers," *IEEE Trans. on Control Systems Technology*, vol. 23, no. 1, pp. 176-185, January 2015.
8. D. Liu, C. Yi, C-C Fong, Q. Jin, Z. Wang, W. K. Yu, **D. Sun**, J. Zhao, M. S. Yang, "Activation of multiple signaling pathways during the differentiation of mesenchymal stem cells cultured in a silicon nanowire microenvironment," *Nanomedicine: Nanotechnology, Biology, and Medicine*, vol. 10, no. 6, pp. 1153-1163, August 2014.
9. C. C. Cheah, X. Li, X. Yan, **D. Sun**, "Observer Based Optical Manipulation of Biological Cells with Robotic Tweezers," *IEEE Trans. on Robotics*, vol. 30, no. 1, pp. 68-80, February 2014.
10. X. Wang, S. Chen, Y-T Chow, C-W Kong, R. A. Li, and **D. Sun**, "A microengineered cell fusion approach with combined optical tweezers and microwell array technologies," *RSC Advances*, vol. 3, pp. 23589-23595, October 2013.
11. K. Wang, J. Cheng, S.H. Cheng, and **D. Sun**, "Probing cell biophysical behavior based on actin cytoskeleton modeling and optical tweezers stretching manipulation," *Applied Physics Letters*, 103, 083706, August 2013.
12. X. Gou, H. Han, S. Hu, A.Y.H. Leung, and **D. Sun**, "Applying combined optical tweezers and fluorescence microscopy technologies to manipulate cell adhesions for cell-to-cell interaction study," *IEEE Trans. on Biomedical Engineering*, vol. 60, no. 8, pp. 2308-2315, August 2013.
13. S. Chen, J. Cheng, C. W. Kong, X. Wang, S. H. Cheng, R. A. Li, and **D. Sun**, "Laser-induced fusion of human embryonic stem cells with optical tweezers," *Applied Physics Letters*, 103, 033701, July 2013.
14. X. Li, C. C. Cheah, S. Hu, and **D. Sun**, "Dynamic trapping and manipulation of biological cells with optical tweezers," *Automatica*, vol. 49, no. 6, pp. 1614-1625, June 2013.
15. S. Hu, X. Gou, H. Han, A. Y. H. Leung, and **D. Sun**, "Manipulating cell adhesions with optical tweezers for study of cell-to-cell interactions," *Biomedical Nanotechnology*, vol. 9, no. 2, pp. 281-285, February 2013.
16. X. Li, **D. Sun**, and J. Yang, "Bounded controller for multirobot navigation while maintaining network connectivity in the presence of obstacles," *Automatica*, vol. 49, pp. 285-292, January 2013.
17. X. Yan, J. Chen, and **D. Sun**, "Multilevel-based topology design and shape control of robot swarms," *Automatica*, vol. 48, no. 12, pp. 3122-3127, December 2012.
18. H. Chen, and **D. Sun**, "Moving Groups of Microparticles into Array with a Robot-tweezers Manipulation System," *IEEE Trans. on Robotics*, vol. 28, no. 5, pp. 1069-1080, October 2012.
19. K. Wang and **D. Sun**, "Influence of semiflexible structural features of actin cytoskeleton on cell stiffness based on actin microstructural modeling," *J. of Biomechanics*, vol. 45, pp. 1900-1908, July 2012.
20. Y. Tan, M. Kong, S. Chen, S. H. Cheng, R. A. Li, and **D. Sun**, "Probing the mechanobiological properties of human embryonic stem cells in cardiac differentiation by optical tweezers," *J. of Biomechanics*, vol. 45, issue 1, pp. 123-128, January 2012.
21. S. Hu, and **D. Sun**, "Automatic transportation of biological cells with robot-tweezer manipulation system," *Int. J. of Robotics Research*, vol. 30, no. 14, pp. 1681-1694, December 2011.
22. X. Wang, S. Chen, M. Kong, Z. Wang, K. Costa, R. Li, and **D. Sun**, "Enhanced cell sorting and manipulation with combined optical tweezer and microfluidic chip technologies," *Lab on a Chip*, vol. 11, no. 21, pp. 3656-3662, 2011.
23. J. Chen, and **D. Sun**, "Resource constrained multirobot task allocation based on leader-follower coalition methodology," *Int. J. of Robotics Research*, vol. 30, pp. 1423-1434, October 2011.
24. Y. Tan, T-K Fung, H. Wan, K. Wang, Anskar Y. H. Leung, and **D. Sun**, "Biophysical characterization of hematopoietic cells from normal and leukemic sources with distinct primitiveness," *Applied Physics Letters*, 99(8), 083702, 2011.
25. Y. Xie, **D. Sun**, C. Liu, H. Y. Tse, and S. H. Cheng, "Force sensing and manipulation strategy in robot-assisted microinjection on zebrafish embryos," *IEEE/ASME Trans. on Mechatronics*, vol. 16, no. 6, pp. 1002-1010, December 2011.
26. Y. Xie, **D. Sun**, C. Liu, H. Y. Tse, and S. H. Cheng, "A force control approach to a robot-assisted cell microinjection system," *Int. J. of Robotics Research*, vol. 29, no. 9, pp. 1222-1232, August 2010.
27. H. Chen, **D. Sun**, J. Yang, and J. Chen, "SLAM based global localization for multi-robot formations in indoor environment," *IEEE/ASME Trans. on Mechatronics*, vol. 15, no. 4, pp. 561—574, August 2010.
28. Y. Tan, **D. Sun**, J. Wang, and W. Huang, "Mechanical characterization of human red blood cells under different osmotic conditions by robotic manipulation with optical tweezers," *IEEE Trans. on Biomedical Engineering*, vol. 57, no. 7, pp. 1816-1825, July 2010.
29. J. Chen, **D. Sun**, J. Yang, and H. Chen, "A leader-follower formation control of multiple nonholonomic mobile robots incorporating receding-horizon scheme," *Int. J. of Robotics*

Research, vol. 29, no. 6, pp. 727-747, May 2010.

30. **D. Sun**, C. Wang, W. Shang, and G. Feng, "A synchronization approach to trajectory tracking of multiple mobile robots while maintaining time-varying formations," *IEEE Trans. on Robotics*, vol. 25, no. 5, pp. 1074-1086, October 2009.
31. H. Huang, **D. Sun**, J. K. Mills, and S. H. Cheng, "Robotics cell injection system with vision and force control: Towards automatic batch biomanipulation," *IEEE Trans. on Robotics*, vol. 25, no. 3, pp. 727-737, June 2009.
32. **D. Sun**, X. Y. Shao and G. Feng, "A model-free cross-coupled control for position synchronization of multi-axis motions: Theory and Experiments," *IEEE Trans. on Control System Technology*, vol. 15, no. 2, pp. 306-314, March 2007.
33. **D. Sun**, L. Ren, J. K. Mills, and C. Wang, "A synchronous tracking control of parallel manipulators using cross-coupling approach," *Int. J. of Robotics Research*, vol. 25, no. 11, pp. 1137-1148, Nov. 2006.
34. Y. X. Su, **D. Sun**, L. Ren, and J. K. Mills, "Integration of saturated PI synchronous control and PD feedback for control of parallel manipulators," *IEEE Trans. on Robotics*, vol. 22, no. 1, pp. 202-207, February 2006.
35. H. Wu, **D. Sun**, and Z. Zhou, "Model identification of a micro air vehicle in loitering flight based on attitude performance evaluation," *IEEE Trans. on Robotics*, vol. 20, no. 4, pp. 702-712, August 2004.
36. J. Shan, **D. Sun**, and D. Liu, "Design for robust component synthesis vibration suppression of flexible structures with on-off actuators," *IEEE Trans. on Robotics and Automation*, vol. 20, no. 3, pp. 512-525, June 2004.
37. **D. Sun**, "Position synchronization of multiple motion axes with adaptive coupling control", *Automatica*, vol. 39, no. 6, pp. 997-1005, June 2003.
38. **D. Sun**, and J. K. Mills, "Adaptive synchronized control for coordination of multi-robot assembly tasks", *IEEE Trans. on Robotics and Automation*, vol. 18, no. 4, pp. 498-510, August 2002.
39. **D. Sun**, and J. K. Mills, "Development of partial model-based torque control of AC induction motors", *IEEE Trans. on Robotics and Automation*, vol. 46, no. 1, pp. 100-107, February 2001.
40. Y. H. Liu, and **D. Sun**, "Stabilizing a flexible beam handled by two manipulators via PD feedback", *IEEE Trans on Automatic Control*, vol. 45, no. 11, pp. 2159-2164, November 2000.

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Links

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