Faa-Jeng Lin *IEEE Fellow, IET Fellow*
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F. J. Lin is currently Chair Professor at the Department of Electrical Engineering, National Central University, Chung-Li, Taiwan. His research interests include intelligent control theories (fuzzy systems, neural networks and evolutionary computation), nonlinear control theories (adaptive and sliding-mode), control theory applications, AC motor servo drives, ultrasonic motor drives, wind turbine generation systems, inverters/converters, DSP-based computer control systems and microgrid. He has published 199 SCI journal papers including 88 IEEE Trans. papers and 125 conference papers and 15 patents in the areas of intelligent control, nonlinear control, motor drives, and mechatronics. Several of these papers have helped to establish research areas such as fuzzy neural network control of motor drives and motion control systems, and resonant converters for piezo-ceramic motor drives. His work has been widely cited; his H-index of 37 in Web of Science reflects over 4507 citations (Profile URL: http://www.researcherid.com/rid/K-4243-2012); his H-index of 51 in Google Scholar reflects nearly 8105 citations. Moreover, he served as the Chair of the Power Engineering Division at the National Science Council, Taiwan, from 2007 to 2009; the Chair of the IEEE IE/PELS Taipei Chapter from 2007 to 2009; the Chair of the IEEE CIS Taipei Chapter from 2012 to 2015. He is an associate editor of *IEEE Transactions on Fuzzy Systems* and *IEEE Transaction on Power Electronics.* He has received significant research funding from NSC/CSIST/ITRI/INER, Taiwan.

Professor Lin is also the chair and principle investigator for Smart Grid Focus Center, National Energy Project in Taiwan. This center aims to integrate Taiwan's R&D resources in smart grid and renewable energy resources to formulate overall development strategies of smart grid and supporting smart grid industries development. The detail can be found in IEEE Smart Grid Newsletters, Aug. 2015. The total research budget is more than $52 million USD for the past five years, and all major research institutes, universities and private companies in the field of smart grid in Taiwan have joined this project. More than thirty major power facilities companies such as Tatung and Delta have invested tens of millions in this project. Under his leadership, the revenues from technology transfer are over $5.6 million USD including smart metering interface, in home display, energy saving adapter, digital protective relay, energy management systems and micro-grid control system. Intelligent systems have also been developed in this project for the converter control of renewable energy resources, modeling and optimization of smart grid, and forecasting of wind and solar power.

Professor Lin has received the Outstanding Research Award from National Science Council (NSC), in 2004, 2010 and 2013. This award is the highest honor bestowed in academia of Taiwan, indicating that the candidate is a pioneering scholar in the intelligent systems and control areas. He also received the Outstanding Electrical Engineering Professor Award from the Chinese Institute of Electrical Engineering in 2005 for his contributions to research and education in his discipline. Moreover, he has received Outstanding Automatic Control Engineering Award from Chinese Automatic Control Society in 2011; the Outstanding Professor of Engineering Award, the Chinese Institute of Engineers, Taiwan, 2016. Furthermore, he is a Fellow of the Institution of Engineering and Technology (IET, former IEE) since 2007 and a Fellow of IEEE since 2017.

Education

1993 Ph. D. Electrical Engineering, National Tsing-Hua University.
1985 M. Sc. Electrical Engineering, National Cheng-Kung University.
1983 B. Sc. Electrical Engineering, National Cheng-Kung University.

Professional Experience

2017- Executive Director, Taiwan Power Company
2016- Board Director, Taiwan Electric Research and testing Center
2013-2017 Director, United Research Centers, National Central University
2010- Chair, Smart Grid Focus Center, National Energy Project I and II, Taiwan
2010- Chair Professor, Department of Electrical Engineering, National Central University
2007-09 Chair, Power Engineering Division, National Science Council, Taiwan
2007-09 Distinguished Professor, Department of Electrical Engineering, National Central University
2006-07 Dean, Office of Academic Affairs, Professor, Department of Electrical Engineering, National Dong Hwa University
2003-05 Dean, Office of Research and Development, Professor, Department of Electrical Engineering, National Dong Hwa University
2001-03 Professor and Chairperson, Department of Electrical Engineering, National Dong Hwa University
1998-01 Professor, Department of Electrical Engineering, Chung Yuan Christian University
1993-98 Associate professor, Department of Electrical Engineering, Chung Yuan Christian University
1989-90 Lecturer, Department of Electrical Engineering , Lien-Ho Institute of Technology
1988-89 Group Leader, Chung-Shan Institute of Science and Technology

(CSIST)
Develop the following system: 1. Automatic testing system for missile. 2. Single board computer system. 3. Measurement and testing of aerodynamic control system.

1987 Testing Engineer, CSIST division at Fort Worth, Texas, U.S.A. Test and design avionics system - MFD, HUD etc.

1985-86 Software and Hardware Engineer, CSIST

Awards

1. Excellent Research Award, National Science Council, Taiwan, 1993 to 2000.
2. Outstanding Research Professor Award, Chung Yuan Christian University, Taiwan, 2000
3. Excellent Young Electrical Engineer Award, the Chinese Electrical Engineering Association, Taiwan, 2000.
4. The Crompton Premium Best Paper Award, the Institution of Electrical Engineers (IEE), United Kingdom, 2002.
5. Best Paper Award, Taiwan Power Electronics Conference, Taiwan, 2004~2006, 2009, 2011.
6. Outstanding Research Award, National Science Council, Taiwan, 2004.
7. Outstanding Research Professor Award, National Dong Hwa University, Taiwan, 2004.
8. Outstanding Technology Award, Precision CNC Servo Competition, Ministry of Education, Taiwan, 2004.
9. Outstanding Professor of Electrical Engineering Award, the Chinese Electrical Engineering Association, Taiwan, 2005.
10. Fellow, The Institution of Engineering and Technology (IET, former IEE), 2007.
11. Distinguished Professor, National Central University, Taiwan, 2008.
12. Project for Outstanding Researcher, National Science Council, Taiwan, 2008.
13. Best Paper Award, Applications Competition of Matlab/Simulink, Taiwan, 2009.
14. Chair Professor, National Central University, Taiwan, 2010.
15. Outstanding Research Award, National Science Council, Taiwan, 2010.
16. Outstanding Automatic Control Engineering Award, Chinese Automatic Control Society, Taiwan, 2011.
17. Best Paper Award, Applications Competition of Texas Instrument Asia, Taiwan, 2012.
18. Chair Professor, National Central University, Taiwan, 2013.
19. Outstanding Contribution Award, Power Engineering Division, National Science Council, Taiwan, 2013.
20. Outstanding Research Award, National Science Council, Taiwan, 2013.
21. Best Paper Award, Industrial Technology Research Institute, Taiwan, 2013.
22. The second place, Texas Instruments innovation challenge DSP/MPU Design Contest 2014, Taiwan.

23. Excellent Patent Awards, National Central University, Taiwan, 2014.
24. Excellent Patent Awards, National Central University, Taiwan, 2015.
25. Outstanding Professor of Engineering Award, the Chinese Institute of Engineers, Taiwan, 2016.
26. Chair Professor, National Central University, Taiwan, 2016.
27. Excellent Patent Awards, National Central University, Taiwan, 2016.
28. The Most Cited Researchers in Electrical and Electronic Engineering: Developed for ShanghaiRanking's Global Ranking of Academic Subjects 2016 by Elsevier
29. Best Paper Award, R. O. C. Symp. on Electrical Power Eng., 2016
30. Fellow, The Institute of Electrical and Electronics Engineers (IEEE), 2017

Activities

IEEE Activities

1. Program Committee Member, IEEE International Conference on Fuzzy Systems (FUZZ-IEEE 2017), 2017
2. Honorary General Co-Chair, 3rd IEEE International Future Energy Electronics Conference (IFEEC), 2017
3. IEEE Fellow (2017-)
4. Associate Editor, IEEE Trans. Power Electronics (PE) (2016-)
5. Honorary Technical Program Chair, 2nd IEEE International Future Energy Electronics Conference (IFEEC), 2015
6. Technical Co-Chair, FUZZ-IEEE 2014
7. Honorary Technical Program Chair, 1st IEEE International Future Energy Electronics Conference (IFEEC), 2013

3. Chair, Taipei Chapter, IEEE Computational Intelligence Society (2012-2015)
4. Chair, Fuzzy Systems on Renewable Energy, Special Session in FUZZ-IEEE 2011, 2012, 2013, 2014, 2016 and 2017
5. Chair, Student Activities and Award Committee, FUZZ-IEEE 2011
6. Associate Editor, IEEE Trans. Fuzzy Systems (FS) (2011-)
7. Chair, Task Force on Fuzzy Systems on Renewable Energy, Fuzzy Systems Technical Committee, IEEE Computational Intelligence Society (2010-)
8. ADCOM candidate, IEEE CIS, 2010
9. Technical Committee Member, Fuzzy Systems Technical Committee, IEEE Computational Intelligence Society (2010-)
10. Program Committee Co-Chair, IEEE Power Electronics and Drives System Conference (2009)
11. Officer, Student Activities, IEEE Taipei Section (2009-2010)
12. Director, IEEE Taipei Section (2009-2010)
13. Chair, Taipei Chapter, IEEE Industrial Electronics and Power Electronics (IE/PEL) Society (2007-2010)
14. IEEE Senior Member (1999-)
15. IEEE Member (1993-1999)

IEEE-Sponsored Conference Activities

1. Program Co-Chair, International Conference on Fuzzy Theory and Its Applications (iFUZZY), 2015
2. General Co-Chair, International Conference on Fuzzy Theory and Its Applications (iFUZZY), 2013
2. Exhibition Committee Co-Chair, International Conference on System Science and Engineering (2010, sponsored by IEEE CIS Taipei Chapter)
3. Award Committee Chair, Best Students' Papers Awards, Taiwan Power Electronics Conference (2009, sponsored by IEEE IE/PEL Taipei Chapter)
4. Award Committee Chair, Best Students' Papers Awards, R. O. C. Symposium on Electrical Power Engineering (2009, sponsored by IEEE IE/PEL Taipei Chapter)
5. Organizing Committee Member, R. O. C. Symposium on Electrical Power Engineering (2006-, sponsored by IEEE IE/PEL Taipei Chapter)
6. Organizing Committee Member, Taiwan Power Electronics Conference (2006-, sponsored by IEEE IE/PEL Taipei Chapter)

Non-IEEE Acitivities

1. Chair, SBRAS-MOST Joint Symposia, 2016 Interdisciplinary Research for Sustainable Development of Energy and Environment
2. President, Taiwan Smart Grid Industry Association (2012-2016)
3. Committee Member, Smart Grid Master Plan, Ministry of Economic Affairs, Taiwan (2011-)
3. Member of Assessment Committee of Universities, Ministry of Education, Taiwan (2011-)
5. Vice President, Taiwan Smart Grid Industry Association (2010-2011)
6. Chair and PI, Smart Grid and AMI, National Energy Project, National Science Council, Taiwan (2010-)
7. Director, The Chinese Automatic Control Society, Taiwan (2010-2011)
8. Chair, Power Engineering Division, National Science Council, Taiwan (2007-2009)
9. Regional Editor – Asia Pacific, IET Electric Power Applications (2009-)
10. Keynote Speaker, Australia Universities Power Engineering Conference (2008)
11. Accreditation Member, Institute of Engineering Education, Taiwan (2007-)
12. Editorial Board, IET Electric Power Applications (2005-)
13. Member of Assessment Committee of Universities of Science and Technology, Ministry of Education, Taiwan (2005-)
14. International Steering Committee Member, IET Linear drives and Industrial Applications Conference (LDIA) (2003-)
15. Editor-in-Chief, Journal of Power Electronics, Taiwan (2003-2007)
16. Organizing Committee Chair, International Computer Symposium, Taiwan (2002)
17. Program Committee Member, Conference on Fuzzy Theory and Its Applications, Taiwan (2002-)
18. Director, Power Electronics Association, Taiwan (2001-)

Areas of Research

1. Intelligent control systems including fuzzy, neural network and GA
2. Ultrasonic, synchronous and induction motor servo drives (rotating and linear)
3. Magnetic levitation
4. Piezoceramic actuator
5. Wind turbine generator system
6. Photovoltaic system
7. Nonlinear and adaptive control
8. Power electronics
9. Microgrid and smart grid
10. DSP-based computer control systems and computer interface
11. Digital and analog circuits, VHDL, Spice

Publications

A. Journal Papers: (Times Cited/Google Scholar, Jan. 2016)

[1] F. J. Lin, S. G. Chen, and I. F. Sun, "Intelligent Sliding-Mode Position Control using Recurrent Wavelet Fuzzy Neural Network for Electrical Power Steering System," International Journal of Fuzzy Systems, published online, 28 June 2017. (SCI) MOST 104-2221-E-008-040-MY3

[2] F. J. Lin, S. G. Chen, Y. T. Liu, and S. Y. Chen, "A Power Perturbation Based MTPA Control with Disturbance Torque Observer for IPMSM Drive System," Transactions of the Institute of Measurement and Control, accepted, 2017. (SCI)

[3] K. C. Lu, F. J. Lin, and B. H. Yang, "Profit Optimization Based Power Compensation Control Strategy for Grid-Connected PV System," IEEE Systems Journal, accepted, 2017. (SCI, IF 2.114) MOST 104-2221-E-008-041-MY3

[4] F. J. Lin, S. G. Chen, and I. F. Sun, "Adaptive Backstepping Control of Six-phase PMSM Using Functional Link Radial Basis Function Network Uncertainty Observer," Asian Journal of Control, vol. 20, no. 1, pp. 1-15, 2018. (SCI, IF 1.556) MOST 104-2221-E-008-040-MY3

[5] F. J. Lin, S. J. Chiang, J. K. Chang, and Yung-Ruei Chang, "Intelligent wind power smoothing control with battery energy storage system," IET Renewable Power Generation, vol. 11, no. 2, pp. 398-407, 2017. (SCI, IF 1.904) MOST 104-2221-E-008-041-MY3

[6] F. J. Lin, S. J. Chiang, and J. K. Chang, "Modeling and Controller Design of PV Micro Inverter without E-cap and Input Current Sensor," Energies, 9, 993, pp. 1-17, 2016. (SCI, IF 2.077) MOST 104-2221-E-008-041-MY3

[7] F. J. Lin, K. C. Lu, and B. H. Yang, "Recurrent Fuzzy Cerebellar Model Articulation Neural Network Based Power Control of Single-Stage Three-Phase Grid-Connected Photovoltaic System during Grid Faults," IEEE

Trans. Industrial Electronics, vol. 64, no. 2, pp. 1258-1268, 2017. (SCI, IF 6.498) MOST 104-2221-E-008-041-MY3
[8] F. J. Lin, Y. H. Chen, S. Y. Lu, and Y. Hsu, “The Smart Grid Technology Development Strategy of Taiwan," Smart Grid and Renewable Energy, vol. 7, pp. 155-163, 2016.
[9] S. J. Chiang, F. J. Lin, J. K. Chang, K. F. Chen, Y. L. Chen, and K. C. Liu, “Control Method for Improving the Response of Single-phase CCM Boost PFC Converter," IET Power Electronics, vol. 9, no. 9, pp. 1792-1800, 2016. (SCI, IF 1.683)
[10] F. J. Lin, K. C. Lu, T. H. Ke, and Y. R. Chang, “Probabilistic Wavelet Fuzzy Neural Network Based Reactive Power Control for Grid-Connected Three-Phase PV System during Grid Faults Renewable Energy,” Renewable Energy, vol. 92, pp. 437-449, 2016. (SCI) MOST 104-2221-E-008-041-MY3
[11] F. J. Lin, K. H. Tan, and C. H. Tsai, “Improved differential evolution based Elman neural network controller for squirrel-cage induction generator system," IET Renewable Power Generation, vol. 10, no. 7, pp. 988-1001, 2016. (SCI, IF 1.904) MOST 104-2221-E-606-003
[12] Y. Y. Hong, F. J. Lin, and T. H. Yu, "Taguchi Method-based Probabilistic Load Flow Studies Considering Uncertain Renewables and Loads," IET Renewable Power Generation, vol. 10, no. 2, pp. 221-227, 2016. (SCI, IF 1.904)
[13] F. J. Lin, I. F. Sun, K. J. Yang, and J. K. Chang, “Recurrent Fuzzy Neural Cerebellar Model Articulation Network Fault-Tolerant Control of Six-Phase PMSM Position Servo Drive,” IEEE Trans. Fuzzy Systems, vol. 24, no. 1, pp. 153-167, 2016. (SCI, IF 8.746) NSC 101-2221-E-008-104-MY3
[14] F. J. Lin, K. C. Lu, T. H. Ke, and H. Y. Li, “Reactive Power Control of Three-Phase PV System during Grids Faults Using Takagi-Sugeno-Kang Probabilistic Fuzzy Neural Network Control,” IEEE Trans. Industrial Electronics, vol. 62, no. 9, pp. 5516-5528, 2015. (SCI, IF 6.498, Times Cited: 4) MOST 103-3113-P-008-001
[15] F. J. Lin, Y. S. Huang, K. H. Tan, and Y. R. Chang, “Active islanding detection method via current injection disturbance using Elman neural network,” Journal of the Chinese Institute of Engineers, vol. 38, no. 4, pp. 517-535, 2015. (SCI, IF 0.241)
[16] F. J. Lin, K. H. Tan, D. Y. Fang, and Y. D. Lee, “Squirrel-Cage Induction Generator System Using Hybrid Wavelet Fuzzy Neural Network Control for Wind Power Applications,” Neural Computing and Applications, vol. 26, pp. 911-928, 2015. (SCI, IF 1.569, Times Cited: 1)
[17] F. J. Lin, K. J. Yang, I. F. Sun, and J. K. Chang, “Intelligent position control of six-phase PMSM using RFNCMAN,” IET Electrical Power Applications, vol. 9, no. 3, pp. 248-264, 2015. (SCI, IF 1.211, Times Cited: 3) NSC 101-2221-E-008-104-MY3
[18] F. J. Lin, K. C. Lu, T. H. Ke, and Y. R. Chang, “Reactive Power Control of Single-Stage Three-phase Photovoltaic System during Grid Faults Using

Recurrent Fuzzy Cerebellar Model Articulation Neural Network," International Journal of Photoenergy, vol. 2014, Article ID 760743, 13 pages, 2014. (SCI, IF 1.563) NSC 103-3113-P-008-001

[19] F. J. Lin, S. Y. Lee, and P. H. Chou, "Intelligent Integral Backstepping Sliding Mode Control Using Recurrent Neural Network for for Piezo-Flexural Nanopositioning Stage," Asian Journal of Control, vol. 17, no. 6, pp. 1-17, 2015. (SCI, IF 1.556) NSC 101-2221-E-008-105-MY3

[20] Y. C. Hung, F. J. Lin, J. C. Hwang, J. K. Chang, and K. C. Ruan, "Wavelet Fuzzy Neural Network with Asymmetric Membership Function Controller for Electric Power Steering System via Improved Differential Evolution," IEEE Trans. Power Electronics, vol. 30, no. 4, pp. 2350-2362, 2015. (SCI, IF 6.008, Times Cited: 5) NSC 101-2221-E-008-104-MY3

[21] Y. Y. Hong, F. J. Lin, and F. Y. Hsu, "Enhanced Particle Swam Optimization-based Feeder Reconfiguration Considering Uncertain Large Photovoltaic Powers and Demands," International Journal of Photoenergy, vol. 2014, ID 704839. (SCI, IF 1.563, Times Cited: 1) NSC 103-3113-P-008-001

[22] Y. Y. Hong, F. J. Lin, S. Y. Chen, Y. C. Lin, and F. Y. Hsu, "A Novel Adaptive Elite-based Particle Swarm Optimization Applied to VAR Optimization in Electric Power Systems," Mathematical Problems in Engineering, vol. 2014, ID 761403. (SCI, IF 0.762, Times Cited: 5) NSC 102-3113-P-008-001

[23] F. J. Lin, Y. C. Hung, C. M. Yeh, and J. M. Chen, "Sensorless inverter-fed compressor drive system using saliency back-EMF based intelligent torque observer with MTPA control," IEEE Trans. Industrial Informatics, vol. 10, no. 2, pp. 1226-1241, 2014. (SCI, IF 8.785, Times Cited: 2) NSC 99-2218-E-008-002

[24] F. J. Lin, Y. C. Hung, and K. C. Ruan, "Intelligent Second Order Sliding Mode Control for Electric Power Steering System Using Wavelet Fuzzy Neural Network," IEEE Trans. Fuzzy Systems, vol. 22, no. 6, pp. 1598-1611, 2014. (SCI, IF 8.746, Times Cited: 4) NSC 101-2221-E-008-104-MY3

[25] Y. Y. Hong, F. J. Lin, Y. C. Lin, and F. Y. Hsu, "Chaotic PSO-based VAR Control Considering Renewables Using Fast Probabilistic Power Flow," IEEE Trans. Power Delivery, vol. 29, no. 4, pp. 1666-1674, 2014. (SCI, IF 1.733, Times Cited: 3) NSC 102-3113-P-008-001

[26] F. J. Lin, S. Y. Lee, and P. H. Chou, "Computed Force Control System Using Functional Link Radial Basis Function Network with Asymmetric Membership Function for Piezo-Flexural Nanopositioning Stage" IET Control Theory Applications, vol. 7, no. 18, pp. 2128-2142, 2013. (SCI, IF 2.048, Times Cited: 4) NSC 101-2221-E-008-105-MY3

[27] F. J. Lin, Y. C. Hung, Z. Y. Kao, and C. M. Yeh, "Sensorless inverter-fed compressor drive system using back EMF estimator with PIDNN torque observer," Asian Journal of Control, vol. 16, no. 4, pp. 1042-1056, 2014. (SCI, IF 1.556, Times Cited: 2)

[28] P. H. Chou, F. J. Lin, C. S. Chen and F. C. Lee, "Three-Degree-of-Freedom

Dynamic Model Based IT2RFNN Control for Gantry Position Stage," Applied Mechanics and Materials, vols. 416-417, pp. 554-558, 2013.

[29] F. J. Lin, K. H. Tan, D. Y. Fang, and Y. D. Lee, "Intelligent controlled three-phase squirrel-cage induction generator system using wavelet fuzzy neural network," IET Renewable Power Generation, vol. 7, no. 5, pp. 552-564, 2013. (SCI, IF 1.904)

[30] C. H. Hsu, C. Y. Lee, Y. H. Chang, F. J. Lin, C. M. Fu, and J. G. Lin, "Effect of Magnetostriction on the Core Loss, Noise, and Vibration of Fluxgate Sensor Composed of Amorphous Materials," IEEE Trans. Magnetics, vol. 49, no. 7, pp. 3862-3865, 2013. (SCI, IF 1.386, Times Cited: 9)

[31] F. J. Lin, Y. S. Huang, K. H. Tan, J. H. Chiu, and Y. R. Chang, "Active islanding detection method using D-axis disturbance signal injection with intelligent control," IET Generation, Transmission & Distribution, vol. 7, no. 5, pp. 537-550, 2013. (SCI, IF 1.353, Times Cited: 11) NSC 100-3113-E-009-003-CC2

[32] F. J. Lin, Y. C. Hung, and M. T. Tsai, "Fault Tolerant Control for Six-Phase PMSM Drive System via Intelligent Complementary Sliding Mode Control Using TSKFNN-AMF," IEEE Trans. Industrial Electronics, vol. 60, no. 12, pp. 5747-5762, 2013. (SCI, IF 6.498, Times Cited: 28) NSC 101-2221-E-008-104-MY3

[33] S. Y. Chen and F. J. Lin, "Decentralized PID Neural Network Control for Five Degree-of-Freedom Active Magnetic Bearing," Engineering Applications of AI, vol. 26, pp. 962-973, 2013. (SCI, IF 2.207, Times Cited: 8) NSC 98-2221-E-008-115-MY3

[34] F. J. Lin, Y. C. Hung, J. C. Hwang, and M. T. Tasi, "Fault Tolerant Control of Six-Phase Motor Drive System Using Takagi-Sugeno-Kang Type Fuzzy Neural Network with Asymmetric Membership Function," IEEE Trans. Power Electronics, vol. 28, no. 7, pp. 3557-3572, 2013. (SCI, IF 6.008, Times Cited: 26) NSC 101-2221-E-008-104-MY3

[35] F. J. Lin, M. S. Huang, Y. C. Hung, C. H. Kuan, S. L. Wang, and Y. D. Lee, "Takagi-Sugeno-Kang type probabilistic fuzzy neural network control for grid-connected LiFePO4 battery storage system," IET Power Electronics, vol. 6, no. 6, pp. 1029-1040, 2013. (SCI, IF 1.683, Times Cited: 5)

[36] F. J. Lin, S. Y. Lee, and P. H. Chou, "Intelligent Nonsingular Terminal Sliding-Mode Control Using MIMO Elman Neural Network for Piezo-Flexural Nanopositioning Stage," IEEE Trans. Ultra. Ferro. Freq. Ctrl., vol. 59, no. 12, pp. 2716-2730, 2012. (SCI, IF 1.512,Times Cited: 12) NSC 101-2221-E-008-105-MY3

[37] F. J. Lin, I. S. Hwang, K. S. Tan, Z. H. Lu, and Y. R. Chang, "Intelligent-controlled of doubly-fed induction generator system using PFNN," Neural Computing and Applications, vol. 22, pp. 1695–1712, 2013. (SCI, IF 1.569, Times Cited: 1)

[38] F. J. Lin, P. H. Chou, C. S. Chen, and Y. S. Lin, "Three-degree-of-freedom dynamic model based intelligent non-singular terminal sliding mode control for

gantry position stage," IEEE Trans. Fuzzy Systems, vol. 20, no. 5, pp. 971-985, 2012. (SCI, IF 8.746 , Times Cited: 6) NSC 97-2221-E-008-098-MY3

[39] F. J. Lin, M. S. Huang, P. Y. Yeh, H. C. Tsai and C. H. Kuan, "DSP-based Probabilistic Fuzzy Neural Network Control for Li-ion Battery Charger," IEEE Trans. Power Electronics, vol. 27, no. 8, pp. 3782-3794, 2012. (SCI, IF 6.008, Times Cited: 42) NSC 99-2218-E-008-003

[40] P. H. Chou, C. S. Chen, and F. J. Lin, "DSP-based synchronous control of dual linear motors via Sugeno type fuzzy neural network compensator," Journal of Franklin Institute, vol. 349, pp. 792-812, 2012. (SCI, IF 2.395, Times Cited: 8) NSC 97-2221-E-008-098-MY3

[41] F. J. Lin, Y. C. Hung, J. C. Hwang, I. P. Chang, and M. T. Tsai, "Digital signal processor-based probabilistic fuzzy neural network control of in-wheel motor drive for light electric vehicle," IET Electric Power Applications, vol. 6, no. 2, pp. 47-61, 2012. (SCI, IF 1.211, Times Cited: 16) NSC 98-2218-E-008-010

[42] F. J. Lin, P. H. Chou, C. S. Chen, and Y. S. Lin, "DSP-based Cross-Coupled Synchronous Control for Dual Linear Motors via Intelligent Complementary Sliding Mode Control," IEEE Trans. Industrial Electronics, vol. 59, no. 2, pp. 1061-1073, 2012. (SCI, IF 6.498, Times Cited: 53) NSC 97-2221-E-008-098-MY3

[43] F. J. Lin, S. H. Lee, H. C. Chang, and Z. Y. Kao, "Design and implementation of sensorless DC inverter-fed compressor drive system," Journal of the Chinese Institute of Engineers, vol. 35, no. 6, pp. 655-673, 2012. (SCI, IF 0.241)

[44] F. J. Lin, J. C. Hwang, K. S. Tan, Z. H. Lu, and Y. R. Chang, "Intelligent Control of doubly-fed induction generator system using PIDNNs," Asian Journal of Control, vol. 14, no. 3, pp. 768-783, 2012. (SCI, IF 1.556, Times Cited: 1)NSC 98-3114-E-008-001-CC2

[45] C. C. Chu, F. J. Lin, and P. T. Cheng, "Smart grid development in Taiwan," IEE Japan Journal of Industry Applications, vol. 1, no. 1, pp. 41-45, 2012.

[46] F. J. Lin, S. Y. Chen, and M. S. Huang, "Adaptive complementary sliding-mode control for thrust active magnetic bearing system," Control Engineering Practice, vol. 19, no. 7, pp. 711-722, 2011. (SCI, IF 1.814, Times Cited: 7) NSC 98-2221-E-008-115-MY3

[47] F. J. Lin, S. Y. Chen, and M. S. Huang, "Intelligent double integral sliding-mode control for five-degree-of-freedom active magnetic bearing," IET Control Theory Applications, vol. 5, no. 11, pp. 1287-1303, 2011. (SCI, IF 2.048, Times Cited: 27) NSC 98-2221-E-008-115-MY3

[48] F. J. Lin, H. J. Hsieh, P. H. Chou, and Y. S. Lin, "Digital signal processor-based cross-coupled synchronous control of dual linear motors via functional link radial basis function network," IET Control Theory Applications, vol. 5, no. 4, pp. 552-564, 2011. (SCI, IF 2.048, Times Cited: 12) NSC 97-2221-E-008-098-MY3

[49] S. Y. Chen and F. J. Lin, "Robust Nonsingular Terminal Sliding-Mode Control for Nonlinear Magnetic Bearing System," IEEE Trans. Control Systems Technology, vol. 19, no. 3, pp. 636-643, 2011. (SCI, IF 2.474, Times Cited: 84)

NSC 98-2221-E-008-115-MY3
[50] F. J. Lin, S. Y. Chen, and M. S. Huang, "Tracking Control of Thrust Active Magnetic Bearing System via Hermite Polynomial-Based Recurrent Neural Network," IET Electric Power Applications, vol. 4, no. 9, pp. 701~714, 2010. (SCI, IF 1.211, Times Cited: 11) NSC 98-2221-E-008-115-MY3
[51] F. J. Lin, J. C. Hwang, P. H. Chou, and Y. C. Hung, "FPGA-based Intelligent-Complementary Sliding-Mode Control for PMLSM Servo Drive System," IEEE Trans. Power Electronics, vol. 25, no. 10, pp. 2573~2587, 2010. (SCI, IF 6.008, Times Cited: 47) NSC 95-2221-E-008-177-MY3
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D. Patents:

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Research Performance

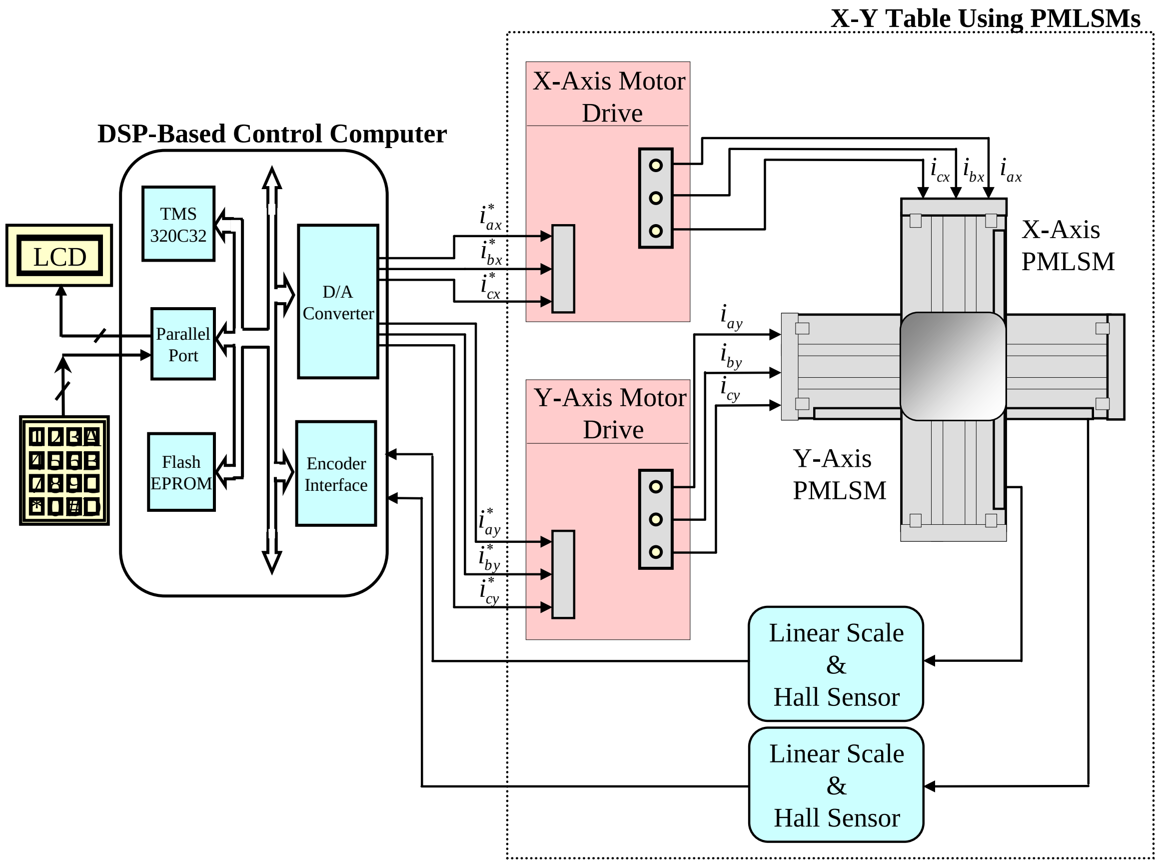
In the past five years, he has produced great research results in the areas of intelligent control theory applications, motor drive and control, power electronics and micro-mechatonics. His results have been particularly distinguished in the areas of advanced intelligent control of AC linear motor servo drives and driving technique development of piezoceramic actuators. According to the journal paper information of IEEE and IET from IEEE Xplore, he has made great contributions in the theoretical innovations and technological developments for above two research areas, and occupies a globally leading role in these fields. Moreover, he also has completed the research and development of the HALL IC and HALL current sensor for the fan motor control, as entrusted to him by MEMT Corporation Ltd., Taiwan, and directed the technology transfer of high power switching power supplies and pulse power supplies entrusted by Shen Chang Electric Corporation Ltd., Taiwan. Currently, he is a consultant for Cell Power Corporation Ltd., Taiwan, to direct the development of synchronous generator drive systems for wind turbine applications. He is also consultant for Jubilee Corporation Ltd., Taiwan, to direct the development of motion control systems and induction generator drive systems for wind turbine applications.

He has achieved 7 important research achievements in the last five years:

- **Two-Axis Motion Control System Using Permanent Magnetic Linear Synchronous Motors**

In modern manufacturing, the design of a two-axis motion control with high-performance and high-precision machining is required. Therefore, the motion control of an X−Y table, which is composed of two permanent-magnet linear synchronous motors (PMLSMs), has become important recently. The direct drive design based on PMLSM has the following advantages over its indirect counterpart: no backlash and less friction; high speed and high precision over long distances; simple mechanical construction, resulting in higher reliability and frame stiffness; and high thrust force. Therefore, PMLSM is suitable for high-performance servo applications and has been used widely for industrial robots, machine tools, semiconductor manufacturing systems, X−Y driving devices, etc.

Apart from completing the developments of a two-axis motion control system composed of two single-axis field-oriented control PMLSMs, a TMS320C32 floating-point DSP was also adopted to be the core of the control computer. Moreover, some hybrid controllers with designs based on Adaptive Backstepping Sliding-Mode, Radial Basis Function Network (RBFN) and Recurrent Neural Network (RNN) have been proposed for two-axis motion control system, in order to achieve high-precision position control.



DSP-based two-axis motion control system

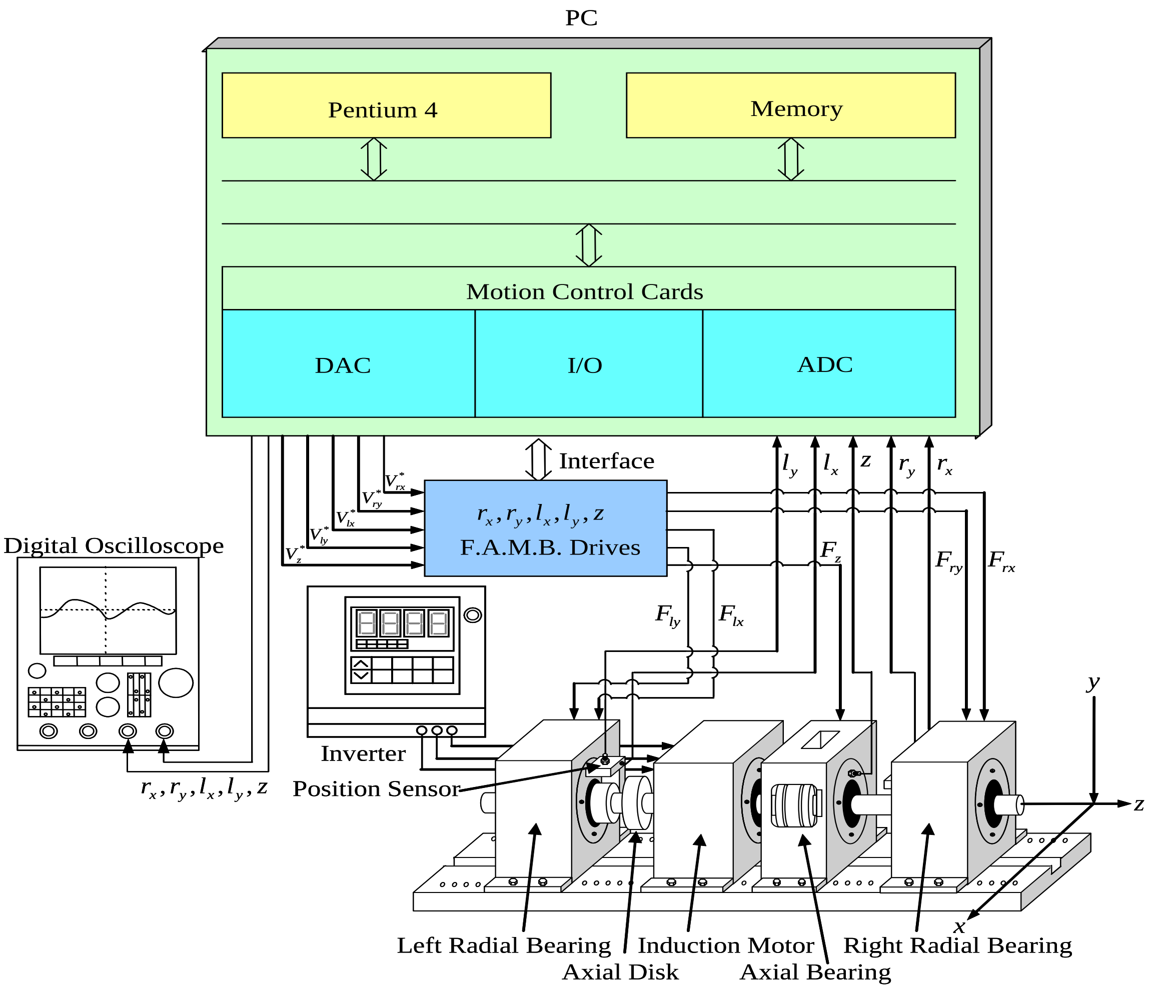
- **Magnetic Levitation System**

Magnetic levitation systems have been successfully implemented for many applications such as frictionless bearings, high-speed maglev passenger trains, and fast-tool servo systems. However, due to the features of the open-loop instability and inherent nonlinearities in the electromechanical dynamics of the magnetic levitation systems, it is very important to develop a high-performance control design for the position control of the levitated object. In general, the electromechanical dynamics of the magnetic levitation systems are represented by a nonlinear model, which consists of the state variables of position, velocity, and coil current signals.

Apart from completing the development of motion control system composed of a magnetic levitation system, a DSP was adopted to become the core of the control computer. Moreover, some hybrid controllers with designs based on Computed Torque, Adaptive Backstepping, Sliding Mode, Recurrent Neural Network (RNN) and Radial Basis Function Network (RBFN) have been proposed for the magnetic levitation system, to achieve high-precision position control.

A decentralised intelligent double integral sliding-mode control (IDISMC) system, which consists of five IDISMCs, to regulate and stabilise a fully suspended five-degree-of-freedom (DOF) active magnetic bearing (AMB) system. The decoupled dynamic model of the five-DOF AMB is analysed for the design of the decentralised control. Moreover, a decentralised integral sliding-mode control (ISMC) system is designed based on the decoupled dynamic model to control the five-DOF

AMB considering the existences of the uncertainties. Furthermore, since the control characteristics of the five-DOF AMB are highly non-linear and time varying, the decentralised IDISMC system, which combines the merits of the ISMC, adaptive control and neural network (NN), is proposed to further improve the control performance of the five-DOF AMB.

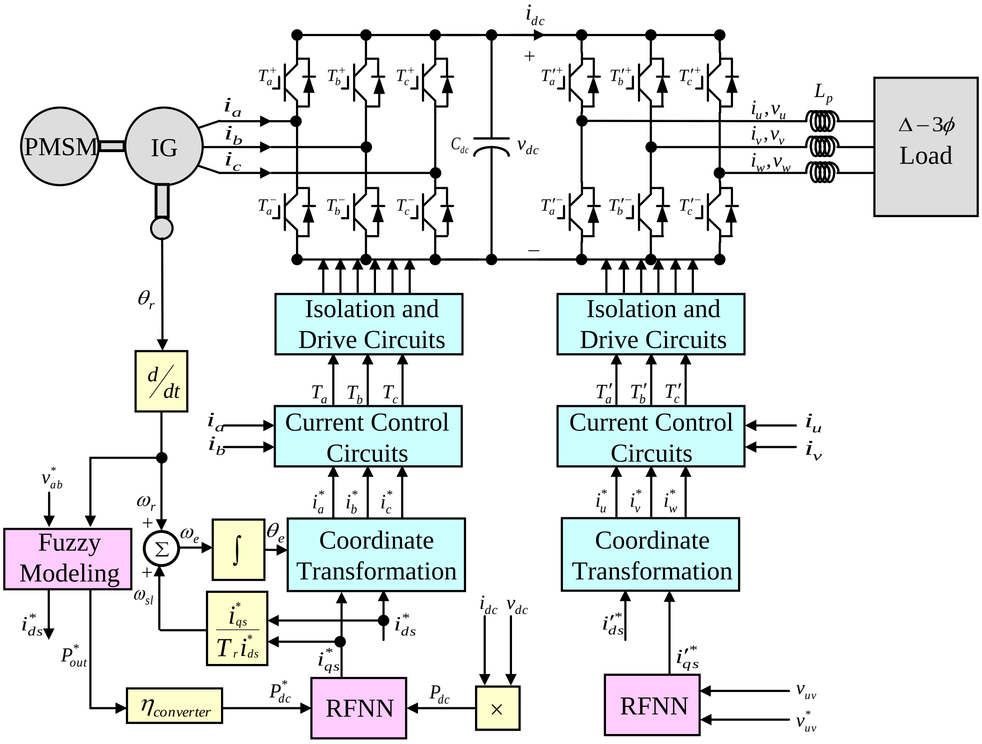


System block of five degree-of-freedom active magnetic bearing

● Wind-Turbine Emulator and Induction Generator System

The recent evolution of power-electronics technologies has aided the advancement of variable-speed wind-turbine generation systems. In spite of the additional cost of power electronics and control circuits, the total energy capture in a variable-speed wind-turbine system is larger compared to a conventional one, resulting in a lower life-cycle cost. However, the variable-speed wind-turbine-driven IG systems show highly resonant, nonlinear and time-varying dynamics subject to wind turbulence and the operating temperature of the IG. Moreover, there is an appreciable amount of fluctuation in the magnitude and frequency of the generator terminal voltage owing to varying rotor speed governed by the wind velocities and the pulsating input torque from the wind turbine. Therefore, the employment of PWM converters with advanced control methodologies to control the wind-turbine-driven IG systems is necessary.

In our research, some intelligent controllers controlling three-phase squirrel-cage IG have been proposed for stand-alone power applications through ac–dc and dc–ac power converters. The electric frequency of the IG is controlled using the indirect field-oriented control mechanism. Moreover, two kinds of the on-line trained neural networks (NNs), Radial Basis Function Network (RBFN) and Recurrent Neural Network (RNN) have been introduced as the regulating controllers for both the dc-link voltage and the ac line voltage of the dc–ac power inverter. Furthermore, the on-line training algorithm based on backpropagation was derived to train the connective weights, means and standard deviations in real time. In addition, an Improved Particle Swarm Optimization (IPSO) algorithm was adopted to adjust the learning rates in the backpropagation process in order to further improve the on-line learning ability and the control performance.

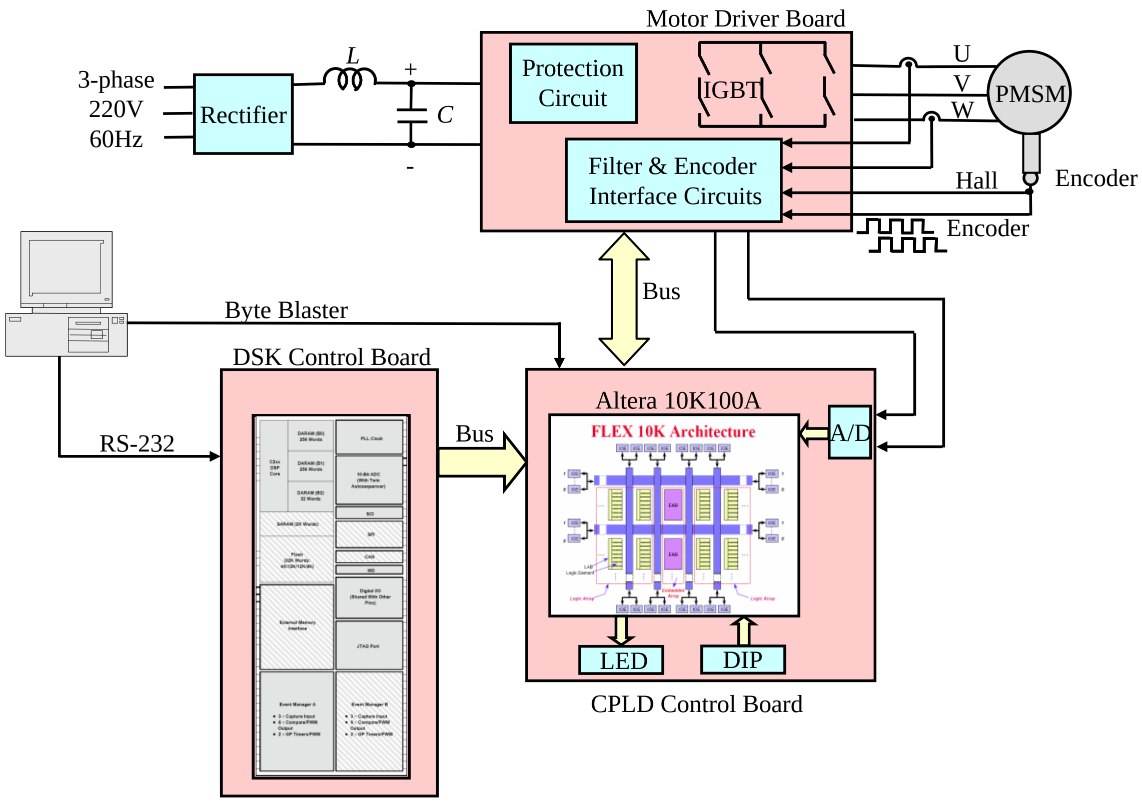


Control block of induction generator system with RFNN control

● Design of Robust Controllers a Using FPGA/CPLD

A field-programmable gate array (FPGA) incorporates the architecture of gate arrays and the programmability of a programmable logic device (PLD). It consists of thousands of logic gates, some of which are combined together to form a configurable logic block (CLB), thereby simplifying high-level circuit design. Interconnections between logic gates using software are externally defined through static random-access memory (SRAM) and read-only memory (ROM), which provide flexibility in modifying the designed circuit without altering the hardware. Moreover, concurrent operation, simplicity, programmability, comparatively low cost, and rapid prototyping make it the favorite choice for prototyping an application-specific integrated circuit (ASIC). Furthermore, all of the internal logic elements and, therefore, all of the control procedures of the FPGA are executed continuously and simultaneously. The circuits and algorithms can be developed in the VHSIC hardware description language (VHDL). This method is as flexible as any software solution.

In our research, apart from completing the motor drives technologies for LIM, LUSM and PMLSM, the development of FPGA-based Fuzzy Sliding-Mode and Adaptive Backstepping Controllers for LIM were also completed. Moreover, various kinds of Neural Networks (NNs) such as Radial Basis Function Network (RBFN) and Recurrent Fuzzy Neural Network (RFNN) are continually developed to achieve high-precision position motor control using a FPGA chip for LUSM and PMLSM.

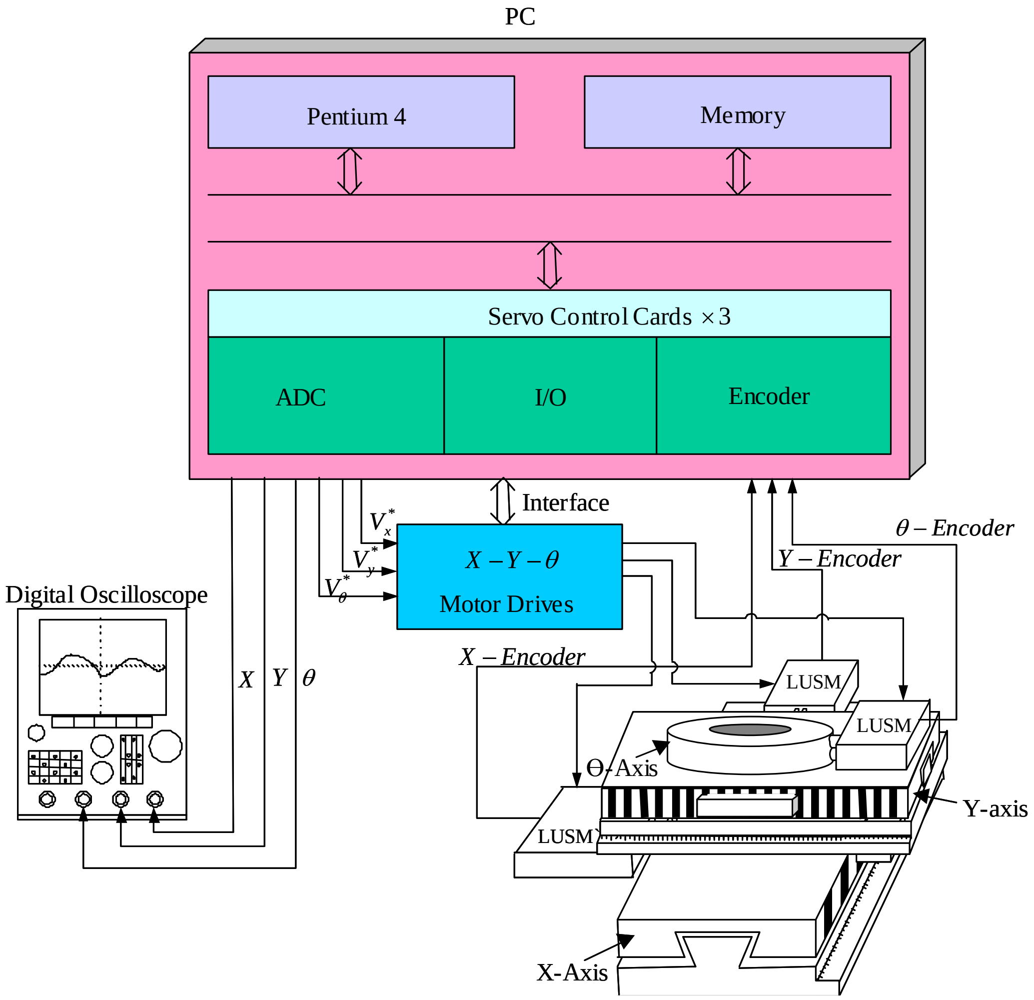


System block of PMSM servo drive

● Motion Control of Piezo-Ceramic Actuators

Due to the requirements of nanometer resolutions in displacement, high stiffness, and fast responses, the piezoactuators are often used in high-precision positioning applications, such as scanning probe microscopy. Because the materials of the piezoactuators are ferroelectric, they fundamentally exhibit hysteresis behavior in their response to an applied electric field. This leads to problems of severe inaccuracy, instability, and restricted system performance due to hysteresis nonlinearity if the piezoactuator is operated in an open-loop fashion. Moreover, the hysteresis characteristics are usually unknown, and the states of representing the hysteresis dynamics are often unmeasured. In order to solve this problem, a new mathematical model based on the differential equation of a motion system with a parameterized hysteretic friction function was developed by us to represent the dynamics of the motion of the piezopositioning mechanism. Then, by using the developed mathematical model, the displacement tracking controller can be developed.

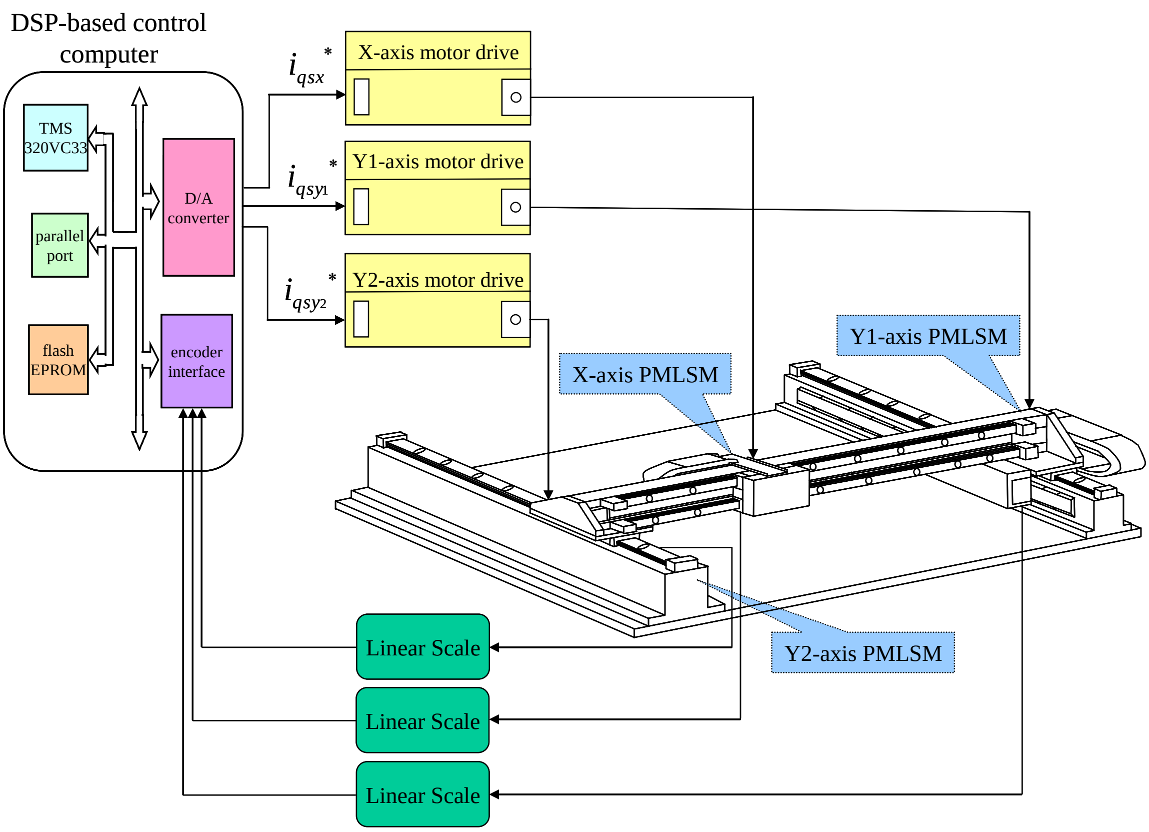
Apart from completing the dynamics of the motion of the single-axis and two-axis piezopositioning mechanisms with the proposed new parameterized hysteretic friction function, various hybrid control systems such as Recurrent Fuzzy Neural Network (RFNN), Adaptive Wavelet Neural Network (AWNN) and Adaptive Recurrent Radial Basis Function Network (ARRBFN) have been developed to achieve nanometer-scale high-precision position control of the single-axis and two-axis piezopositioning mechanisms. In addition, a robust adaptive FNN backstepping control system has been proposed to control the position of an X-Y-θ motion control stage using LUSMs to track various contours. The online training algorithms of the FNN are derived from the stability analyses.



X-Y-θ Motion Control Stage Using Linear Ultrasonic Motors

- **Motion Control of Gantry Position Stage**

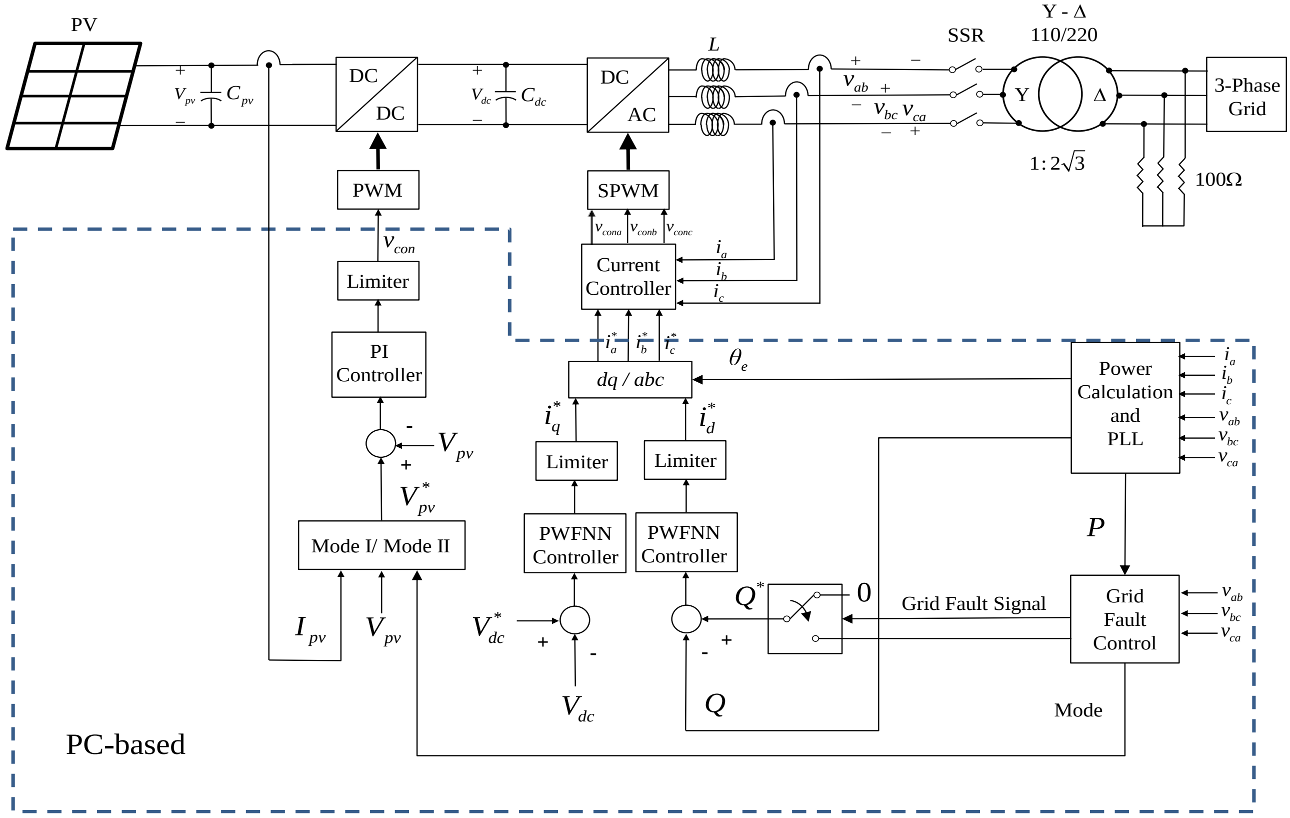
A cross-coupled intelligent-complementary-sliding-mode-control (ICSMC) system has been proposed for the synchronous control of a dual linear motor servo system installed in a gantry position stage. The dual linear motor servo system with two parallel permanent magnet linear synchronous motors is installed in a gantry position stage. The dynamic model of single-axis motion control system with a lumped uncertainty, which comprises parameter variations, external disturbances, and nonlinear friction force, is introduced first. Then, to achieve an accurate trajectory tracking performance with robustness, a cross-coupled ICSMC is developed. In this approach, a Takagi–Sugeno–Kang-type fuzzy neural network estimator with accurate approximation capability is implemented to estimate the lumped uncertainty. Moreover, since a cross-coupled technology is incorporated into the proposed intelligent control scheme for the gantry position stage, both the position tracking and synchronous errors of the dual linear motors will simultaneously converge to zero. Comparing to the traditional control, the synchronous speed is increased from 1.2m/sec to 2m/sec.



System block of gantry position stage

● **Intelligent control of PV system using PWFNN with LVRT under grid fault**

An intelligent controller based on probabilistic wavelet fuzzy neural network (PWFNN) has been developed for the reactive and active power control of a three-phase grid-connected photovoltaic (PV) system during grid faults. The inverter of the three-phase grid-connected PV system should provide a proper ratio of reactive power to meet the low-voltage ride through (LVRT) regulations and control the output current without exceeding the maximum current limit simultaneously during grid faults. Therefore, the proposed intelligent controller regulates the value of reactive power to a new reference value, which complies with the regulations of LVRT under grid faults. Moreover, a dual-mode operation control method of the converter and inverter of the three-phase grid connected PV system is designed to eliminate the fluctuation of dc-link bus voltage under grid faults.



Intelligent control of PV system using PWFNN with LVRT under grid fault