Faa-Jeng Lin (林法正)　IEEE /IET/CIEE/AAIS Fellow
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Professor Lin is currently Chair Professor at the Department of Electrical Engineering, National Central University (NCU), Taiwan. He is also Deputy Minister, National Science and Technology Council (NSTC), Taiwan, and Executive Director, Taiwan Power Company. His research interests include AC servo motor drives, photovoltaic power generation systems, wind turbine generation systems, smart grid, intelligent control theories (fuzzy systems, neural networks and evolutionary computation), nonlinear control theories (adaptive and sliding-mode), control theory applications, inverters/converters, and DSP-based computer control systems. For the past 30 years, he has published nearly 230 SCI journal papers including 113 IEEE Trans. Papers, 149 conference papers and 19 patents in the areas of intelligent control, nonlinear control, motor drives, renewable energy and smart grid. His H-index of 65 in Google Scholar reflects 13382 citations. Moreover, his work has been widely cited. Several of these papers have helped to establish research areas such as fuzzy neural network control of motor drives and motion control systems, and intelligent control of renewable energy resources. He has been elevated to Fellow by the IEEE in 2017. Additionally, he was President, National Applied Research Laboratories (NARLabs), Taiwan, from 2022 to 2024; Dean, College of Electrical Engineering and Computer Science, NCU, from 2021-2022.

Areas of Research

1. Synchronous and induction motor servo drives (rotating and linear)
2. Renewable energy systems
3. Microgrid and smart grid
4. Intelligent control systems including fuzzy, neural network and evolutionary computation
5. Nonlinear and adaptive control
6. Power electronics
7. Magnetic levitation
8. Piezoceramic actuator
9. DSP-based computer control systems and computer interface
10. Digital and analog circuits, VHDL, Spice

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

2024- Board Director, National Chung-Shan Institute of Science and Technology (NCSIST)
2024- Deputy Minister, National Science and Technology Council (NSTC), Taiwan
2022-2024 President, National Applied Research Laboratories, Taiwan
2023- Board Director, National Atomic Research Institute, Taiwan
2021-2022 Dean, College of Electrical Engineering and Computer Science, National Central University
2021-2024 Board Director, United Renewable Energy Company, Taiwan
2019-2021 Member, Science and Technology Policy Advisory Office, Board of Science & Technology, Executive Yuan, Taiwan
2017- Executive Director, Taiwan Power Company
2017-2021 Adjunct Research Fellow, Office of Science and Technology, Executive Yuan, Taiwan
2016-2021 Board Director, Taiwan Electric Research and testing Center
2013-2017 Director, United Research Centers, National Central University
2010-2019 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 Award, National Central University, Taiwan, 2014.
24. Excellent Patent Award, 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 Award, 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
31. Project for Research Fellow, MOST, 2017
32. Excellent Patent Award, National Central University, Taiwan, 2018.
33. Excellent Technology Transfer Award, National Central University, Taiwan, 2018.
34. Chair Professor, National Central University, Taiwan, 2019.
35. Honorary Chair Professor, National Chin-Yi University of Technology, Taiwan, 2019.
36. Best Paper Award, Proc. 17th Taiwan Power Electronics Conference, 2020
37. Best Paper Award, 41th R. O. C. Symp. on Electrical Power Eng., 2020
38. Excellent Technology Transfer Award, National Central University, Taiwan, 2020.
39. Project for Research Fellow, MOST, 2020
40. Outstanding Research Fellow Award, MOST, Taiwan, 2021.
41. Excellent Industry and University Cooperation Award, National Central University, Taiwan, 2022.
42. Chair Professor, National Central University, Taiwan, 2022.
43. 29th TECO Award, 2022.
44. Fellow, The Chinese Institution of Electrical Engineering (CIEE), Taiwan, 2022.
45. Fellow, Asia-Pacific Artificial Intelligence Association (AAIA), 2023. Now International Academy of Artificial Intelligence Sciences (AAIS) since Jan. 2016.
46. Outstanding Contribution Award of Power Electronics, Taiwan Power Electronics Association, 2023.
47. Engineering Medal of Electrical Engineering, The Chinese Institution of Electrical Engineering (CIEE), Taiwan, 2024.
48. Best Paper Award 2024 International Automatic Control Conference (CACS), Oct. 31, 2024, Taoyuan, Taiwan.
49. The 69 th Academic Award, Ministry of Education
50. Best Paper Award, Proc. 22th Taiwan Power Electronics Conference, 2025
51. Best Poster Presentation Award, IEEE Industrial Applications Society 2025 (IAS2025) Annual Meeting, June 2025, New Taipei City, Taiwan.

Academic Activities

IEEE Activities

1. Member of IEEE SMC, IE and CIS Fellow Evaluating Committee (2018-)
2. Keynote Speaker, IEEE International Conference on Intelligent Green Building and Smart Grid (IEEE IGBSG), China Three Gorges University, Sep., 2019
3. Speaker, IEEE SMC Beijing Capital Region Chapter Seminar, University of Science and Technology Beijing, Nov. 12, 2018
4. Keynote Speaker, IEEE International Conference on Intelligent Green Building and Smart Grid (IEEE IGBSG), Taiwan, Apr. 22-25, 2018
5. Program Committee Member, IEEE International Conference on Fuzzy Systems

(FUZZ-IEEE 2017), 2017
6. Honorary General Co-Chair, 3rd IEEE International Future Energy Electronics Conference (IFEEC), 2017
7. IEEE Fellow (2017-)
8. Associate Editor, IEEE Trans. Power Electronics (PE) (2016-2025)
9. Honorary Technical Program Chair, 2nd IEEE International Future Energy Electronics Conference (IFEEC), 2015
10. Technical Co-Chair, FUZZ-IEEE 2014
11. Honorary Technical Program Chair, 1st IEEE International Future Energy Electronics Conference (IFEEC), 2013
12. Chair, Taipei Chapter, IEEE Computational Intelligence Society (2012-2015)
13. Chair, Fuzzy Systems on Renewable Energy, Special Session in FUZZ-IEEE 2011-2022
14. Chair, Student Activities and Award Committee, FUZZ-IEEE 2011
15. Associate Editor, IEEE Trans. Fuzzy Systems (FS) (2011-2018, 2025-)
16. Chair, Task Force on Fuzzy Systems on Renewable Energy, Fuzzy Systems Technical Committee, IEEE Computational Intelligence Society (2010-2017)
17. ADCOM candidate, IEEE CIS, 2010
18. Technical Committee Member, Fuzzy Systems Technical Committee, IEEE Computational Intelligence Society (2010-)
19. Program Committee Co-Chair, IEEE Power Electronics and Drives System Conference (2009)
20. Officer, Student Activities, IEEE Taipei Section (2009-2010)
21. Director, IEEE Taipei Section (2009-2010)
22. Chair, Taipei Chapter, IEEE Industrial Electronics and Power Electronics (IE/PEL) Society (2007-2010)
23. IEEE Senior Member (1999-)
24. IEEE Member (1993-1999)

<u>IEEE-Sponsored Conference Activities</u>
1. General Co-Chair, The 2018 International Automatic Control Conference (CACS 2018), Taoyuan City, Taiwan
2. General Co-Chair, International Conference on Fuzzy Theory and Its Applications (iFUZZY), 2017
3. Program Co-Chair, International Conference on Fuzzy Theory and Its Applications (iFUZZY), 2015
4. General Co-Chair, International Conference on Fuzzy Theory and Its Applications (iFUZZY), 2013
5. Exhibition Committee Co-Chair, International Conference on System Science and Engineering (2010, sponsored by IEEE CIS Taipei Chapter)
6. Award Committee Chair, Best Students' Papers Awards, Taiwan Power Electronics Conference (2009, sponsored by IEEE IE/PEL Taipei Chapter)
7. Award Committee Chair, Best Students' Papers Awards, R. O. C. Symposium on Electrical Power Engineering (2009, sponsored by IEEE IE/PEL Taipei Chapter)

8. Organizing Committee Member, R. O. C. Symposium on Electrical Power Engineering (2006-, sponsored by IEEE IE/PEL Taipei Chapter)
9. Organizing Committee Member, Taiwan Power Electronics Conference (2006-, sponsored by IEEE IE/PEL Taipei Chapter)
10. Program Committee Member, Conference on Fuzzy Theory and Its Applications, Taiwan (2002-2022)

Non-IEEE Acitivities

1. General Co-Chair, International Conference "Green Energy and Smart Grids" August 6-10, 2018, Irkutsk, Russia
2. Member of International editorial board, Energy Systems Research, Melentiev Energy Systems Institute, SB RAS.
3. Chair, SBRAS-MOST Joint Symposia, 2017 GREEN ENERGY: SMART GRID
4. Honorary President, Taiwan Smart Grid Industry Association (2018-)
5. Chair, SBRAS-MOST Joint Symposia, 2016 Interdisciplinary Research for Sustainable Development of Energy and Environment
6. President, Taiwan Smart Grid Industry Association (2012-2016)
7. Committee Member, Smart Grid Master Plan, Ministry of Economic Affairs, Taiwan (2011-)
8. Member of Assessment Committee of Universities, Ministry of Education, Taiwan (2011-2012)
9. Vice President, Taiwan Smart Grid Industry Association (2010-2011)
10. Chair and PI, Smart Grid and AMI, National Energy Project, National Science Council, Taiwan (2010-2018)
11. Director, The Chinese Automatic Control Society, Taiwan (2010-2011)
12. Chair, Power Engineering Division, National Science Council, Taiwan (2007-2009)
13. Regional Editor – Asia Pacific, IET Electric Power Applications (2009-2017)
14. Keynote Speaker, Australia Universities Power Engineering Conference (2008)
15. Accreditation Member, Institute of Engineering Education, Taiwan (2007-)
16. Editorial Board, IET Electric Power Applications (2005-2008)
17. Member of Assessment Committee of Universities of Science and Technology, Ministry of Education, Taiwan (2005-2016)
18. International Steering Committee Member, IET Linear drives and Industrial Applications Conference (LDIA) (2003-2016)
19. Editor-in-Chief, Journal of Power Electronics, Taiwan (2003-2007)
20. Organizing Committee Chair, International Computer Symposium, Taiwan (2002)
21. Director, Power Electronics Association, Taiwan (2001-2007)

Important Academic Contributions

Academic Achievements

Prof. Lin's contributions are well recognized by the intelligent control and renewable energies communities; he is a pioneering researcher in his discipline. According to the databases of IEEE Xplore and Thomson Reuters ISI Web of Science, he is the pioneer to apply fuzzy neural network on real-time control of the servo motor drive, which can increase the control precision of the motor servo drives. Therefore, IEEE Systems, Man, & Cybernetics (SMC) Magazine invited Prof. Lin to publish his contribution in an invited article "Online Autotuning of a Servo Drive Using Wavelet Fuzzy Neural Network to Search for the Optimal Bandwidth" in its Oct. 2018 issue. Moreover, he has very distinguished contribution in the development of intelligent control technologies of microgrid and smart grids and renewable energy resources, which can increase the penetration rate of renewable energy resources. According to the databases of IEEE Xplore and Thomson Reuters ISI Web of Science, he is also the pioneer to apply fuzzy neural network on real-time control of PV power plant and microgrid. Owing to his contributions on the intelligent control of microgrid, the following two articles: "Increasing the Penetration Rate of Renewable Energy Resources by Intelligent Controlled Microgrid" and "Intelligent Control of Grid-Connected Microgrid with Virtual Inertia" have been published by Taiwan Research Highlight, Engineering & Technologies, in 2020 and 2021, respectively.

Listed below are evidence of the impact of Prof. Lin's work: his H-index of 65 in Google Scholar reflects 13382 citations (Nov. 2024). In addition, in the "World's Top 2% Scientists 2020", which was released by Stanford University recently by using Scopus publication impact scores (https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/3?fbclid=IwAR3hwMId0tq0xhZPCGwiXtLEdwuvn7TToIafNeLgF8ezaRT9lQ__svOHvc4), his total ranking is 16,699 among nearly 8 million scholars (Lin, Faa Jeng); his ranking in the subfield of Electrical & Electronic Engineering is 41 among all 105,029 scholars worldwide. He is literally a highly cited scholar in his expertise field. Furthermore, In the "World's Top 2% Scientists 2022" (https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/6), his total ranking is 16,699; his ranking in the subfield of Electrical & Electronic Engineering is 46 among 111,935 scholars worldwide. Additionally, the total research budget of him from NSTC is more than 80 million NTD for the past 8 years (2017-2024).

Prof. Lin's contributions are well recognized by the power and control engineering communities. He has received the Outstanding Research Award from National Science Council (NSC), now NSTC, in 2004, 2010 and 2013. This award is one of the highest honors bestowed in academia of Taiwan, indicating that he 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; Chair Professor Award from National Central University in 2010, 2013, 2016, 2019 and 2022; Honorary Chair Professor Award from National Chin-Yi University of Technology in 2019; Outstanding Research Fellow Award, Ministry of Science and Technology (MOST), Taiwan, 2021. Furthermore, he is a Fellow of the Institution of Engineering and Technology (IET, former IEE) since 2007. In addition, owing to his contributions to intelligent control systems for motor drives and motion control, he has been elevated to Fellow by the IEEE in 2017.

Prof. Lin's career is dedicated to the development of intelligent AC motor servo drive systems, and intelligent control techniques for smart grid and renewable energy resources for more than 30 years. He has a good reputation in this research field both in the national and international communities. His contributions to the development of smart grid technologies and industries in Taiwan are well recognized. Therefore, he has received the 29th TECO Award, 2022, in the field of Mechanical Engineering/Energy/Environmental Technology, Outstanding Contribution Award of Power Electronics, Taiwan Power Electronics Association, 2023 and Engineering Medal of Electrical Engineering, The Chinese Institution of Electrical Engineering (CIEE), Taiwan, 2024.

Industrial Cooperation

Prof. Lin is also served as a consultant for industries in Taiwan and has transferred many technologies to several companies in Taiwan. For instance, sensorless control of synchronous motor drive using high-frequency signal injection technology has been transferred to Myson Century Inc. in 2013; active filter algorithm for microgrid has been transferred to Chung-Hsin Electric Machinery Mfg. Inc. in 2017; low voltage ride through technology for the grid connected PV power plant has been transferred to Controlnet International Inc. also in 2017; PV and battery energy storage system management system for microgrid has been transferred to NextDrive Inc., Taiwan, in 2019; intelligent parameters identification and gain autotuning technologies have been transferred to Racing Electric Instrument Inc., Taiwan, and Delta Electronics Inc., Taiwan, for new type of servo motor drives in 2018 and 2021, respectively.

Through the project "Research of Power Regulation and Field Implementation for Smart Multi-level Microgrid" of MOST in 2021, a 100-kW smart multi-level microgrid demo site is designed and constructed in NCU. The demo site can be operated in both grid-connected and islanded mode with 100% renewable energy including 70-kW solar power, 35-kW fuel cell, and 110-kWh energy storage system. In addition, the technologies of energy management system of micorgrid have been transferred to NextDrive Inc. and Taiwan Cement Company (TCC) in 2022. These two companies will develop their technologies and products, such as aggregator and grid-connected battery energy storage system, to join the ancillary

service of Taiwan Power Company. The scale of the business has been estimated to be a few billion NTD per year. In addition, the total payment from the private companies for the technologies transferring of him is over 10 million NTD for the past 8 years (2017-2024). Additionally, the technologies of energy management system of microgrid also have been transferred to Wistron Inc. in 2024 to help the company to build its intelligent grid dispatch system with information/communication/control of energy. The technology transfer fees are 9.5 million NTD and Prof. Lin is the co-PI. Thus, his contributions have high impact to the smart grid and renewable energy industries in Taiwan.

Academic Services

Prof. Lin was principal investigator (PI) of the National Energy Program (NEP) "Energy Research Collaboration between Taiwan's top universities and elite research centers and The California Institute of Technology (CALTECH)" from 2012 to 2014. The total research budget is 157 million NTD for three years. Under the support of this program, CALTECH and Taiwan's top universities and elite research centers jointly supported faculty members to carry out research projects on relevant topics of energy technologies such as fuel cells, solar PV, thermoelectric, CO2 capture and conversion, biofuels and smart grid. One of the CALTECH participants Dr. Frances Arnold has won the 2018 Nobel Prize in Chemistry for "the directed evolution of enzymes," according to the award citation. Parts of her contributions were supported by this project. Moreover, her counterparts in Academia Sinica, Taiwan, are still using the directed evolution of enzymes in their laboratory for the development of biofuel technologies.

He was the chair and PI for Smart Grid Focus Center Project, NEP, 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 industries development (IEEE Smart Grid Newsletters, Aug. 2015). The total research budget was more than 1.6 billion NTD for five years (2014~2018), and all major research institutes, universities and private companies in the field of smart grid have joined this project. More than thirty major power facilities companies such as Tatung and Delta have invested billions NTD in this project. Under his leadership, the revenues from technology transfer are over 197 million NTD 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. Additionally, he has also held the position of Executive Director at Taiwan Power Company for many years, assisting in the planning of smart grid technology research and the direction of industry development. In 2022, the Singapore Power Group ranked 94 global electricity companies based on the Smart Grid Index, and Taiwan Power Company was ranked second in the world.

The candidate previously served as the President of NARLabs, where he led NARLabs towards steady growth and development, while supporting the government in advancing technological initiatives. The results of his efforts across three main pillars are as follows: (1) The candidate fully utilized NARLabs' interdisciplinary research strengths to assist NSTC in executing the "Net Zero Technology Program," accelerating the layout and practical application of forward-looking net-zero technologies. He also supported the "Chip Innovation Program" to advance generative AI, pioneering semiconductor processes, and advanced IC design, thereby fostering academic research and promoting new industries. (2) He advanced an organizational enhancement plan to optimize human resources, improve various management mechanisms, and facilitate digital transformation within NARLabs, while strengthening talent retention and recruitment measures to build an agile team. (3) He published NARLabs' first sustainability report, presenting the management performance of various ESG and SDGs sustainability issues, underscoring the institution's commitment and determination toward sustainable operations.

Talent Foster

Under the candidate's leadership and guidance, his research teams have graduated a total of 17 doctoral students and 130 master's students over the past thirty years. Under the candidate's rigorous supervision and training, students' research foundations are solid. In addition to publishing 230 SCIE international journal papers with students, the students have also received numerous prestigious awards both domestically and internationally. These include the Best Paper Award at the Industrial Technology Research Institute's Mechanical and Systems Research Institute in 2013, and the second place in the Texas Instruments Innovation Challenge DSP/MPU Design Contest 2014 in Taiwan, among others. Students have also won multiple Outstanding Paper Awards at the Taiwan Power Electronics Conference and Power Engineering Conference, the National Science Council's Future Technology Award, and the National Central University President's Scholarship. Graduates are now employed at academic institutions both in Taiwan and abroad (such as National Taiwan University of Science and Technology, National Taiwan Normal University, National United University, National Defense University, etc.), research and development organizations (such as ITRI, Taiwan Institute of Economic Research, National Chung-Shan Institute of Science and Technology, Chunghwa Telecom Research Institute, etc.), as well as in the industry, contributing to the development of Taiwan's high-tech industries.

During the candidate's tenure as the PI of Smart Grid Focus Center Project, NEP, Taiwan, significant attention was paid to talent development. In the second phase of the program (2014-2018), in addition to promoting various smart grid demonstration projects and assisting Taiwan Power Company in implementing smart grid-related infrastructure, a total of 189 doctoral students and 869 master's

students participated in the program (according to the final project report of the second phase of the NEP). Many of these students are now employed in domestic smart grid and green energy-related industries, research institutions, and state-owned enterprises.

As the Dean of the College of Electrical Engineering and Computer Science at National Central University, the candidate served as the lead for the Ministry of Education's "University Students' Bilingual Learning Program." This program primarily focuses on enhancing bilingual learning for college students and promotes the use of English-language instruction in undergraduate courses at the College of Electrical Engineering and Computer Science at National Central University. This initiative aims to improve students' English skills to meet industry needs, enhance the international competitiveness of faculty and students, and attract more international students to study at the university.

Five most distinct contributions of the candidate in recent 5 years

In the past three decades, he has produced great research results in the areas of intelligent control theory applications, servo motor drive and control, renewable energy resources control and microgrid. His results have been particularly distinguished in the areas of advanced intelligent control of AC servo motor drives and intelligent control of microgrid and renewable energy sources. 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. The most important five research achievements in recent five years are listed below:

- **Intelligent Control Technologies of Smart Grid and Renewable Energy Sources**

The development of operation and intelligent control technologies of smart grid and renewable energy sources (RESs) including active islanding detection, control of battery energy storage system (BESS), control of three-phase squirrel-cage induction generator (IG), low-voltage ride through (LVRT) control of PV system for weak grid condition is very important for the increasing of penetrating rate of RESs. Some intelligent controlled RESs have been proposed for stand-alone or grid-connected power applications through ac–dc and dc–ac power converters. Moreover, fuzzy neural networks (FNNs) based intelligent controllers 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 algorithms based on backpropagation have been derived to train the connective weights, means and standard deviations of the FNNs in real time [1]-[4]. In addition, voltage stabilization is an important task for the microgrid power control [2]. The long transient response of voltage caused by the grid transition from the grid-connected

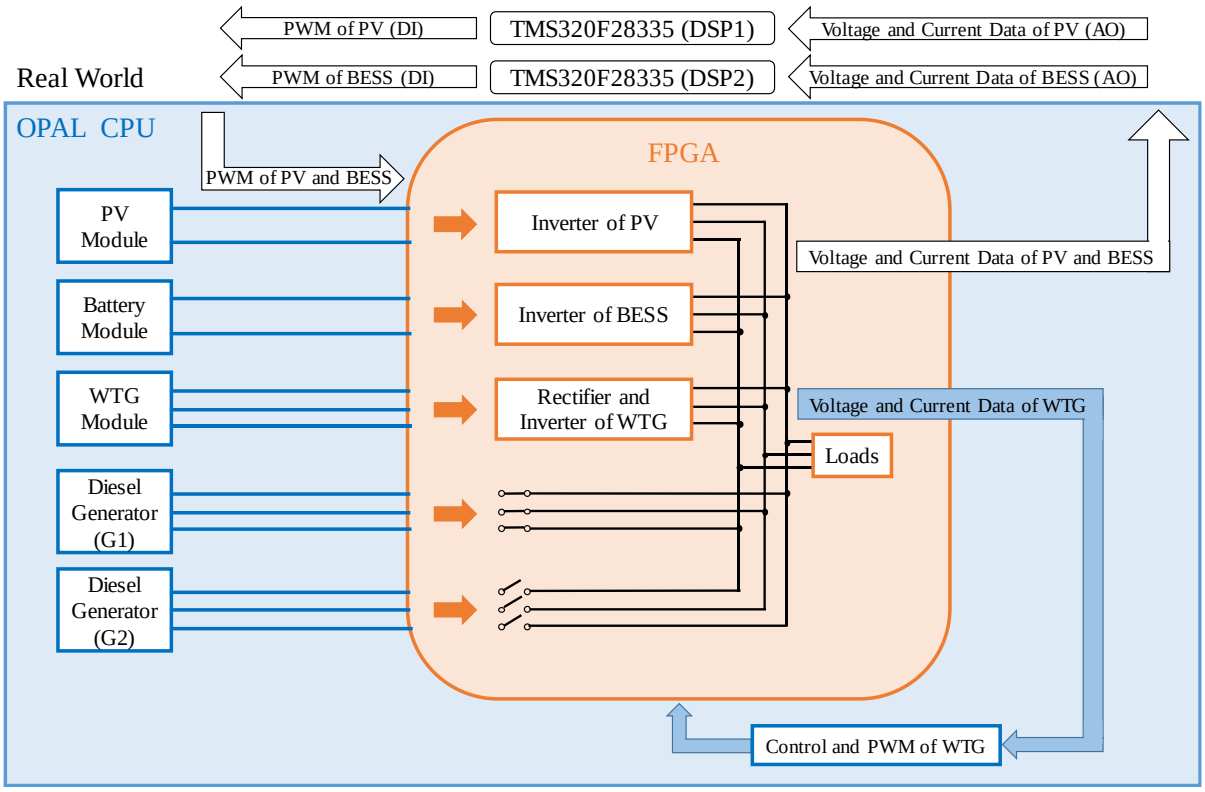
mode to the islanded mode or the power variations would deteriorate the operation of the voltage protective relay. This would lead to the difficulty of integration for the renewable energy and the storage system. To solve this problem, the asymmetric membership function based wavelet petri fuzzy neural network (AMFWPFNN) controller is proposed for the voltage stabilization control of storage system in [2] to provide fast response speed and mitigate the transient impact. To investigate the performance of the proposed microgrid controller and examine the compliance with the settings in IEC Std. 60255, Cimei Island in Taiwan is studied. Through the hardware in the loop (HIL) mechanism built with OPAL-RT real-time simulator as shown in the following figure [2], the effectiveness of proposed controller can be verified. The intelligent control algorithms for both the PV and BESS are implemented using two separate TMS320F28335 DSPs as shown in the following figure. Additionally, the most important publications of recent five years are listed below:

[1] F. J. Lin, K. H. Tan, W. C. Luo, and G. D. Xiao,"Improved LVRT Performance of PV Power Plant Using Recurrent Wavelet Fuzzy Neural Network Control for Weak Grid Condition," IEEE Access, vol. 8, pp. 69346-69358, 2020.

[2] F. J. Lin, C. I. Chen, G. D. Xiao, and P. R. Chen,"Voltage Stabilization Control for Microgrid with Asymmetric Membership Function Based Wavelet Petri Fuzzy Neural Network," IEEE Trans. Smart Grid, vol. 12, no. 5, pp. 3731-3741, 2021. (Increasing the Penetration Rate of Renewable Energy Sources by Intelligent Controlled Microgrid, Taiwan Research Highlight, Engineering & Technologies, Nov. 16, 2021)

[3] F. J. Lin, J. C. Liao, C. I. Chen and P. R. Chen, "Voltage Restoration Control for Microgrid with Recurrent Wavelet Petri Fuzzy Neural Network," IEEE Access, vol. 10, pp. 12510-12529, 2022.

[4] F. J. Lin, J. C. Liao, Y. M. Zhang, and Y. C. Huang, "Optimal Economic Dispatch and Power Generation for Microgrid Using Lagrange Multipliers-based Method with HIL Verification," IEEE Systems Journal, vol. 17, no. 3, pp. 4533-4544, 2023.



Structure of OPAL-RT and peripherals for power control [2]

- **Intelligent Fuzzy Neural Networks Controllers with for IPMSM Servo Drive System**

This research aims to create FNNs based intelligent control systems to alter the inherent nonlinear and time-varying control characteristics of an interior permanent magnet synchronous motor (IPMSM) drive system in practical applications by using intelligent control algorithms [5]-[8]. Novel maximum torque per ampere (MTPA) method based on power perturbation for a field-oriented control (FOC) IPMSM drive system was also proposed. Moreover, the influence of current and voltage harmonics to the MTPA control can be eliminated effectively. In [7], an intelligent nonsingular terminal sliding mode control recurrent Petri probabilistic fuzzy neural network (INTSMCRPPFNN) that features an intelligent nonsingular terminal sliding mode control was proposed for an IPMSM servo drive as shown in the following figure. First, a nonsingular terminal sliding mode control (NTSMC) system was designed in [7] to track the states of a nonlinear time-varying system. Creating a working NTSMC for practical applications is quite complex because the detailed system dynamics, which includes the unpredictability of the controlled plant, is not available beforehand. Thus, a recurrent Petri probabilistic fuzzy neural network with asymmetric membership function (RPPFNN-AMF) which can act as a close substitute for the ideal NTSMC to resolve its existing complications was suggested in [7]. Furthermore, asymptotical stability is assured by using the Lyapunov stability method, which generates the RPPFNN-AMF's online learning algorithms. The proposed control algorithms are implemented in a TMS320F28075

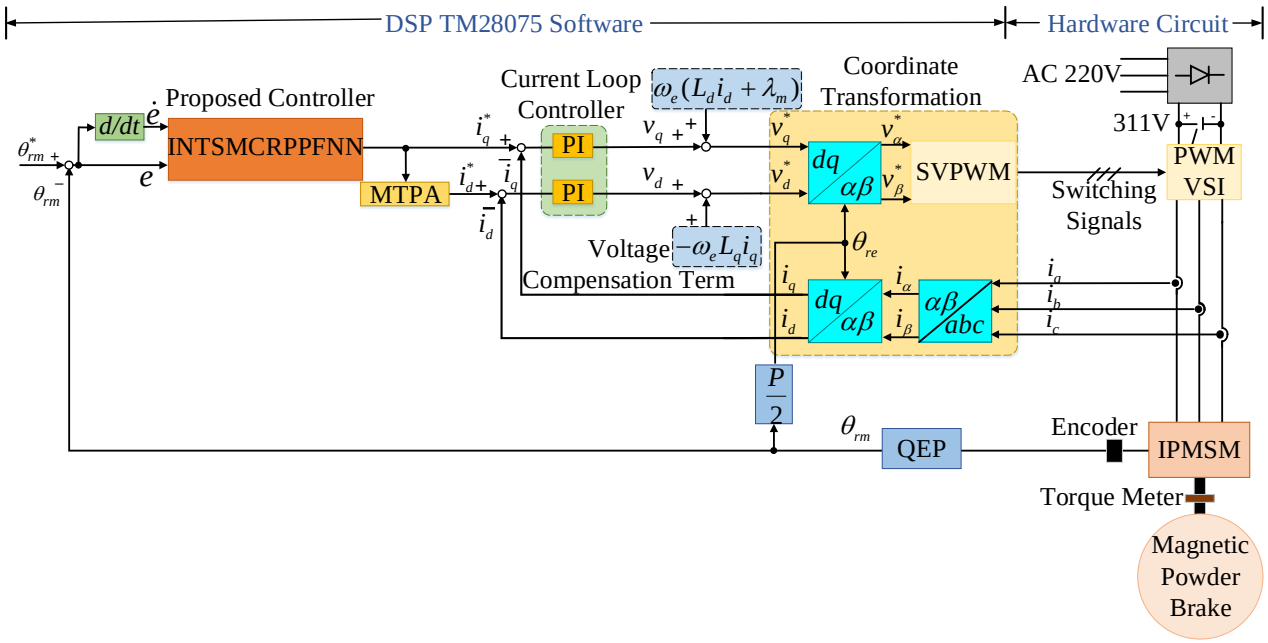
32-bit DSP with 120MHz as shown in the following figure [7]. Additionally, the most important publications of recent five years are listed below:

[5] F. J. Lin, S. G. Chen, S. Li, H. T. Chou, and J. R. Lin, "Online Auto-Tuning Technique for IPMSM Servo Drive by Intelligent Identification of Moment of Inertia," IEEE Trans. Industrial Informatics, vol. 16, no. 12, pp. 7579-7590, 2020.

[6] F. J. Lin, C. W. Liu, and P. L. Wang, "Voltage Control of IPMSM Servo Drive in Constant Power Region with Intelligent Parameter Estimation," IEEE Access, vol. 10, pp. 99243-99256, 2022.

[7] F. J. Lin, P. L. Wang, and I. M. Hsu, "Intelligent Nonsingular Terminal Sliding Mode Controlled Nonlinear Time-Varying System Using RPPFNN-AMF," IEEE Trans. Fuzzy Systems, vol. 32, no. 3, pp. 1036 -1049, 2024.

[8] F. J. Lin, F. H. Deng, and P. Y. Huang, "Intelligent Backstepping Control of Nonlinear Time-Varying System with Interval Type-2 Recurrent Fuzzy Neural Network Estimator," IEEE Access, vol. 12, pp. 135873-135885, 2024.



Control block diagram of intelligent control DSP-based IPMSM position servo drive [7]

- **High-performance Synchronous Reluctance Motor Drive System Using Intelligent Control**

The purpose of this research is to develop a high-performance synchronous reluctance motor (SynRM) drive system and its control methods [9]-[12]. Since the SynRM does not require the rare earth permanent magnet, it can possess both the characteristics of high efficiency and performance. Moreover, the DSP-based position and speed controllers are developed to control the high-performance SynRM drive system. The core of the hardware processor is a Texas Instruments TMS320F28075 DSP, and the proposed control methods are realized in the DSP

using the “C” language. Furthermore, the rotor position and speed of SynRM are measured by using an encoder via peripheral expansion circuit board and quadrature encoder pulse interface, and the phase current signals are obtained by using the hall current sensors and via the analog to digital converter. Finally, a SynRM drive system using the FOC is achieved. In terms of controller design, the developed intelligent backstepping control (IBSC), adaptive computed current (ACC) speed control, recurrent feature selection fuzzy neural network (RFSFNN) and recurrent Legendre fuzzy neural network (RLFNN) are adopted to improve the speed and position control performance of SynRM and to achieve the MTPA control for minimizing the stator copper loss. The most important publications of recent five years are listed below:

[9] F. J. Lin, M. S. Huang, S. G. Chen, C. W. Hsu, and C. H. Liang “Adaptive Backstepping Control for Synchronous Reluctance Motor Based on Intelligent Current Angle Control,” IEEE Trans. Power Electronics, vol. 35, no. 7, pp. 7465–7479, 2020.

[10] S. G. Chen, F. J. Lin, C. H. Liang, and C. H. Liao, “Intelligent Maximum Power Factor Searching Control Using Recurrent Chebyshev Fuzzy Neural Network Current Angle Controller for SynRM Drive System,” IEEE Trans. Power Electronics, vol. 36, no. 3, pp. 3496-3511, 2021.

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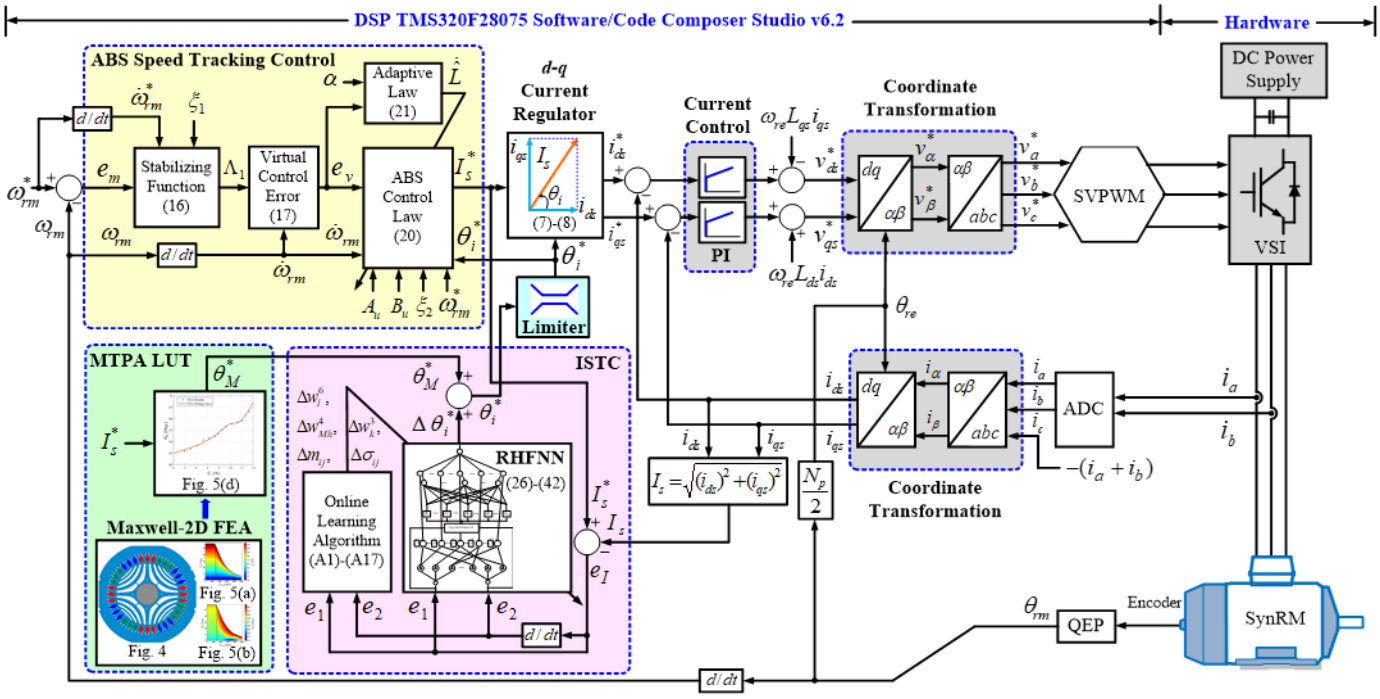

High-performance Synchronous Reluctance Motor Drive System Using Intelligent Control [9]

● Intelligent Control of Grid-Connected Microgrid with Virtual Inertia

A microgrid with virtual inertia using master–slave control is proposed in this research to overcome the drawbacks of traditional inverter-based distributed generators for lack of inertia and without grid-forming capability [13]-[15]. The microgrid using master–slave control is composed of a storage system, a PV system and a varying resistive three-phase load. The storage system and PV system are regarded as the master unit and the slave unit, respectively, in the microgrid. Moreover, in order to improve the reactive power control in grid-connected mode and the transient response of microgrid during the switching between the grid connected mode and islanding mode, an online trained recurrent probabilistic wavelet fuzzy neural network (RPWFNN) is proposed to replace the conventional proportional-integral (PI) controller in the storage system in [13] as shown in the following figure. Furthermore, when the microgrid is operated in islanding mode, the load variation will have serious influence on the voltage control of the microgrid. Thus, the RPWFNN control was also proposed to improve the transient and steady-state responses of voltage control in the microgrid. Additionally, the most important publications of recent five years are listed below:

[13] K. H. Tan, F. J. Lin, C. M. Shih, and C. N. Kuo, “Intelligent Control of Microgrid with Virtual Inertia Using Recurrent Probabilistic Wavelet Fuzzy Neural Network,” IEEE Trans. Power Electronics, vol. 35, no. 7, pp. 7451-7464, 2020. (Intelligent Control of Grid-Connected Microgrid with Virtual Inertia, Taiwan Research Highlight, Engineering & Technologies, March 20, 2020)

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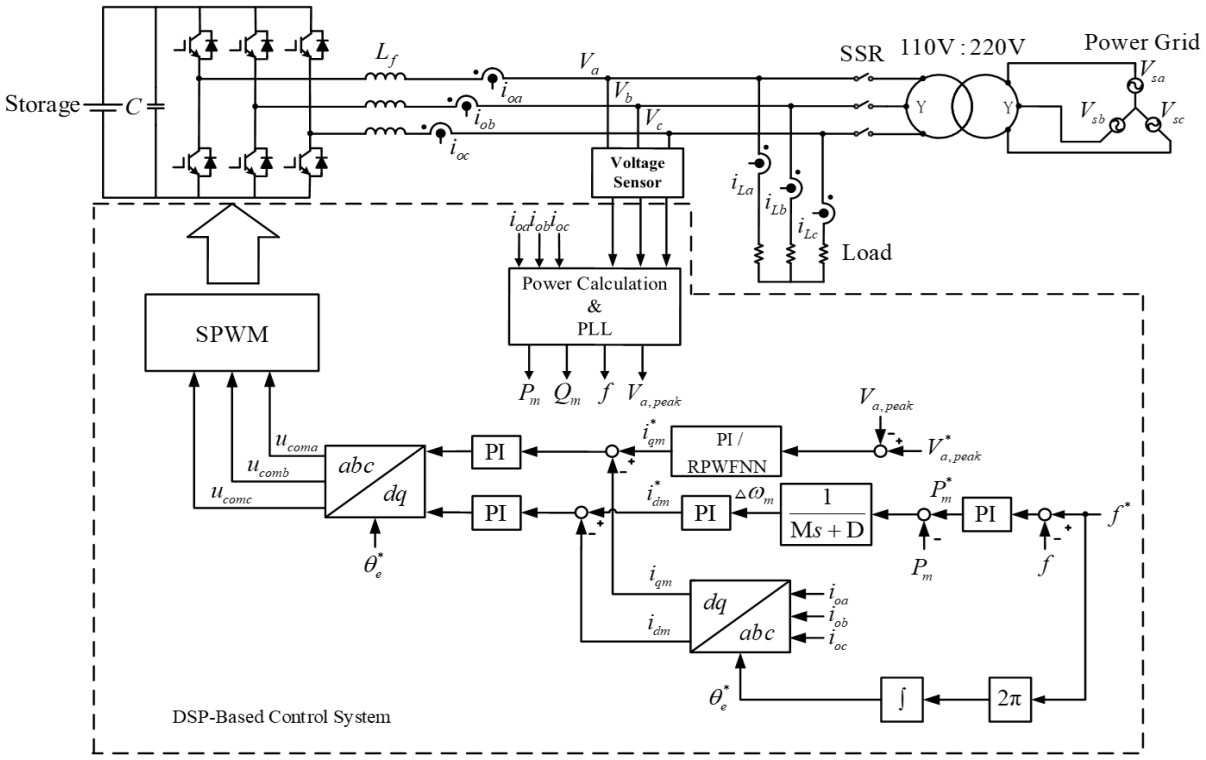
[15] F. J. Lin, K. H. Tan, X. Y. Weng, and Y. R. Li, “An Improved Droop Control of Microgrid Using Intelligent Variable Droop Coefficient Estimation,” IEEE Journal of Emerging and Selected Topics in Power Electronics, vol. 12, no. 4, pp. 4117-4132, Aug. 2024.



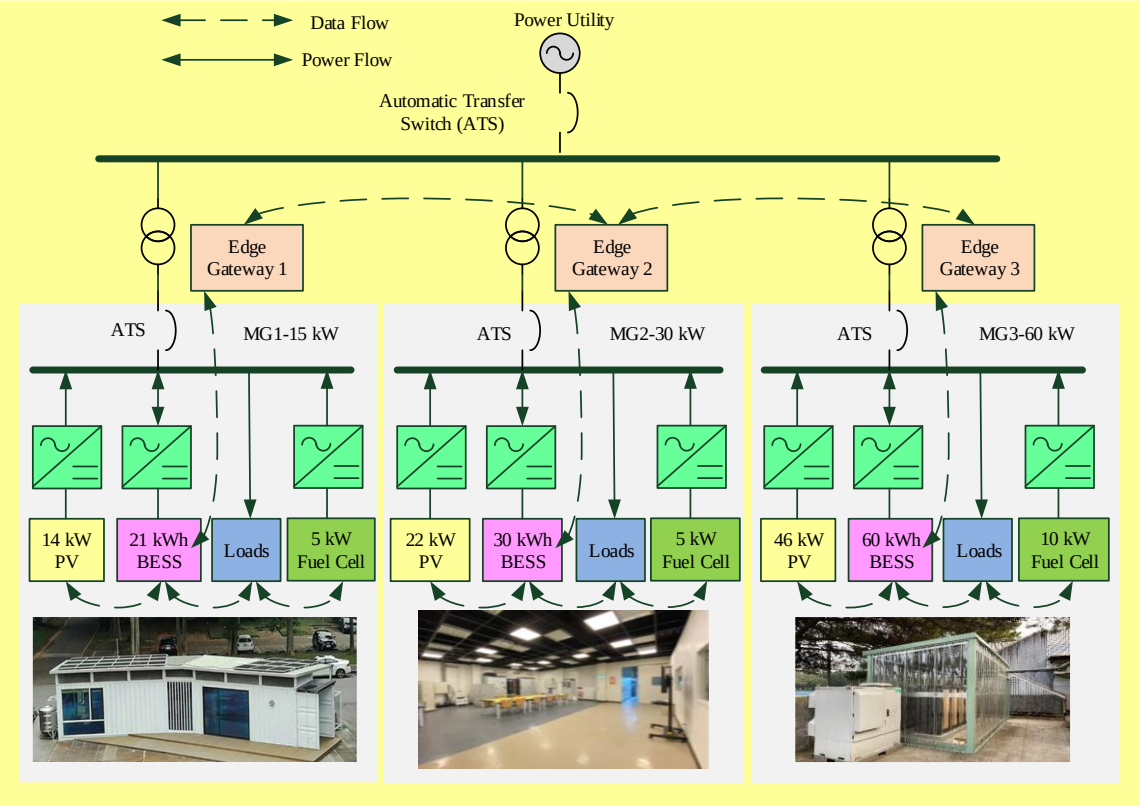
Control Block of Intelligent Control of Grid-Connected Microgrid with Virtual Inertia [13]

● Field Implementation for Smart Multi-level Microgrid

Through the project "Research of Power Regulation and Field Implementation for Smart Multi-level Microgrid" of MOST in 2021, a 100-kW smart multi-level microgrid demo site is designed and constructed in NCU. The demo site can be operated in both grid-connected and islanded mode with 100% renewable energy including 70-kW solar power, 35-kW fuel cell, and 110-kWh energy storage system. The interconnected microgrid system can provide power supply for each other. In this way, the non-planning energy can be regarded as the backup power source and promote the optimization of energy usage. To achieve the optimal power regulation and stability of system operation, this project has designed a smart multi-level interconnected microgrid based on intelligent control techniques considering the distributed control architecture and operation cost of grid. The key techniques in this project include: (1) power converter design and control with the power sharing function, (2) coordinated control of renewable energy and load shedding strategy for the individual microgrid, (3) energy management and optimization of operation cost in the microgrid, (4) power control and regulation technique for the interconnected microgrid, (5) optimal energy dispatch and control for the interconnected microgrid, (6) model of fuel cell and dynamic control strategy in the microgrid, and (7) power generation forecasting technique of renewable energy. The field implementation and photos are shown in the following figures.

Through this project, the technologies of energy management system of micorgrid have been transferred to NextDrive Inc. and Taiwan Cement Company

(TCC) in 2022. These two companies will develop their technologies and products, such as aggregator and grid-connected battery energy storage system, to join the ancillary service of Taiwan Power Company. The scale of the business has been estimated to be a few billion NTD per year. Moreover, the technologies of energy management system of microgrid also have been transferred to Wistron Corporation in 2024 to help the company to build its intelligent grid dispatch system with information/communication/control of energy.



Field Implementation of 100-kW Smart Multi-Level Microgrid in NCU

Switches of Solar Panel of MG2 and MG3

Installation of Solar Panel

Storage Systems of MG2 and MG3

Switches of Interconnected System

Hydrogen Fuel Cell

MG1 System

Photos of 100-kW Smart Multi-Level Microgrid in NCU

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