

# References

- [1] M. Busu, “The role of renewables in a low-carbon society: Evidence from a multi-variate panel data analysis at the eu level,” *Sustainability*, vol. 11, no. 19, p. 5260, 2019.
- [2] P. E. Allen and G. P. Hammond, “Bioenergy utilization for a low carbon future in the uk: the evaluation of some alternative scenarios and projections,” *BMC Energy*, vol. 1, no. 1, p. 3, 2019.
- [3] S. Prasad, V. Venkatramanan, and A. Singh, “Renewable energy for a low-carbon future: policy perspectives,” *Sustainable Bioeconomy: Pathways to Sustainable Development Goals*, pp. 267–284, 2021.
- [4] V. Grewe, A. Gangoli Rao, T. Grönstedt, C. Xisto, F. Linke, J. Melkert, J. Middel, B. Ohlenforst, S. Blakey, S. Christie *et al.*, “Evaluating the climate impact of aviation emission scenarios towards the paris agreement including covid-19 effects,” *Nature Communications*, vol. 12, no. 1, p. 3841, 2021.
- [5] A. Jahid, M. S. Hossain, M. K. H. Monju, M. F. Rahman, and M. F. Hossain, “Techno-economic and energy efficiency analysis of optimal power supply solutions for green cellular base stations,” *IEEE Access*, vol. 8, pp. 43 776–43 795, 2020.
- [6] K. Mahmoud and M. Lehtonen, “Comprehensive analytical expressions for assessing and maximizing technical benefits of photovoltaics to distribution systems,” *IEEE Transactions on Smart Grid*, vol. 12, no. 6, pp. 4938–4949, 2021.
- [7] O. M. Babatunde, J. L. Munda, and Y. Hamam, “A comprehensive state-of-the-art survey on hybrid renewable energy system operations and planning,” *IEEE Access*, vol. 8, pp. 75 313–75 346, 2020.

- [8] P. in collaboration with IIT Bombay, “Report on assessment of inertia in indian power system.”
- [9] K. Tian, W. Sun, D. Han, and C. Yang, “Coordinated planning with predetermined renewable energy generation targets using extended two-stage robust optimization,” *IEEE Access*, vol. 8, pp. 2395–2407, 2019.
- [10] B. Faridpak, A. Alahyari, M. Farrokhifar, and H. Momeni, “Toward small scale renewable energy hub-based hybrid fuel stations: Appraising structure and scheduling,” *IEEE Transactions on Transportation Electrification*, vol. 6, no. 1, pp. 267–277, 2020.
- [11] V. V. Murty and A. Kumar, “Optimal energy management and techno-economic analysis in microgrid with hybrid renewable energy sources,” *Journal of Modern Power Systems and Clean Energy*, vol. 8, no. 5, pp. 929–940, 2020.
- [12] Z. Xu, G. Han, L. Liu, M. Martinez-Garcia, and Z. Wang, “Multi-energy scheduling of an industrial integrated energy system by reinforcement learning-based differential evolution,” *IEEE Transactions on Green Communications and Networking*, vol. 5, no. 3, pp. 1077–1090, 2021.
- [13] W. U. Rehman, A. R. Bhatti, A. B. Awan, I. A. Sajjad, A. A. Khan, R. Bo, S. S. Haroon, S. Amin, I. Tlili, and O. Oboreh-Snapps, “The penetration of renewable and sustainable energy in asia: A state-of-the-art review on net-metering,” *IEEE Access*, vol. 8, pp. 170 364–170 388, 2020.
- [14] G. India, “Renewable energy integration” by grid-india.”
- [15] K. R. Vasudevan, V. K. Ramchandaramurthy, T. S. Babu, and A. Pouryekta, “Synchronverter: A comprehensive review of modifications, stability assessment, applications and future perspectives,” *IEEE Access*, vol. 8, pp. 131 565–131 589, 2020.
- [16] H.-P. Beck and R. Hesse, “Virtual synchronous machine,” in *2007 9th international conference on electrical power quality and utilisation*. IEEE, 2007, pp. 1–6.

- [17] J. Driesen and K. Visscher, "Virtual synchronous generators," in *2008 IEEE power and energy society general meeting-conversion and delivery of electrical energy in the 21st century*. IEEE, 2008, pp. 1–3.
- [18] Y. Chen, R. Hesse, D. Turschner, and H.-P. Beck, "Improving the grid power quality using virtual synchronous machines," in *2011 international conference on power engineering, energy and electrical drives*. IEEE, 2011, pp. 1–6.
- [19] Q.-C. Zhong and G. Weiss, "Static synchronous generators for distributed generation and renewable energy," in *2009 IEEE/PES Power Systems Conference and Exposition*. IEEE, 2009, pp. 1–6.
- [20] Y. Chen, R. Hesse, D. Turschner, and H.-P. Beck, "Investigation of the virtual synchronous machine in the island mode," in *2012 3rd IEEE PES Innovative Smart Grid Technologies Europe (ISGT Europe)*. IEEE, 2012, pp. 1–6.
- [21] Q.-C. Zhong, "Power-electronics-enabled autonomous power systems: Architecture and technical routes," *IEEE Transactions on Industrial Electronics*, vol. 64, no. 7, pp. 5907–5918, 2017.
- [22] O. Mo, S. D'Arco, and J. A. Suul, "Evaluation of virtual synchronous machines with dynamic or quasi-stationary machine models," *IEEE Transactions on industrial Electronics*, vol. 64, no. 7, pp. 5952–5962, 2016.
- [23] S. D'Arco and J. A. Suul, "Equivalence of virtual synchronous machines and frequency-droops for converter-based microgrids," *IEEE Transactions on Smart Grid*, vol. 5, no. 1, pp. 394–395, 2013.
- [24] J. Liu, Y. Miura, and T. Ise, "Comparison of dynamic characteristics between virtual synchronous generator and droop control in inverter-based distributed generators," *IEEE Transactions on Power Electronics*, vol. 31, no. 5, pp. 3600–3611, 2015.
- [25] S. D'Arco and J. A. Suul, "Virtual synchronous machines—classification of implementations and analysis of equivalence to droop controllers for microgrids," in *2013 IEEE Grenoble Conference*. IEEE, 2013, pp. 1–7.

- [26] J. A. Suul, S. D'Arco, and G. Guidi, "Virtual synchronous machine-based control of a single-phase bi-directional battery charger for providing vehicle-to-grid services," *IEEE Transactions on Industry Applications*, vol. 52, no. 4, pp. 3234–3244, 2016.
- [27] J. Liu, Y. Miura, H. Bevrani, and T. Ise, "Enhanced virtual synchronous generator control for parallel inverters in microgrids," *IEEE Transactions on Smart Grid*, vol. 8, no. 5, pp. 2268–2277, 2016.
- [28] Y. Hirase, K. Sugimoto, K. Sakimoto, and T. Ise, "Analysis of resonance in microgrids and effects of system frequency stabilization using a virtual synchronous generator," *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 4, no. 4, pp. 1287–1298, 2016.
- [29] P. F. Frack, P. E. Mercado, M. G. Molina, E. H. Watanabe, R. W. De Doncker, and H. Stagge, "Control strategy for frequency control in autonomous microgrids," *IEEE Journal of Emerging and Selected Topics in power electronics*, vol. 3, no. 4, pp. 1046–1055, 2015.
- [30] M. Ashabani and Y. A.-R. I. Mohamed, "Integrating vses to weak grids by nonlinear power damping controller with self-synchronization capability," *IEEE Transactions on Power Systems*, vol. 29, no. 2, pp. 805–814, 2013.
- [31] H. Alrajhi Alsiraji and R. El-Shatshat, "Comprehensive assessment of virtual synchronous machine based voltage source converter controllers," *IET Generation, Transmission & Distribution*, vol. 11, no. 7, pp. 1762–1769, 2017.
- [32] A. Muhtadi, D. Pandit, N. Nguyen, and J. Mitra, "Distributed energy resources based microgrid: Review of architecture, control, and reliability," *IEEE Transactions on Industry Applications*, vol. 57, no. 3, pp. 2223–2235, 2021.
- [33] F. Blaabjerg, Y. Yang, K. A. Kim, and J. Rodriguez, "Power electronics technology for large-scale renewable energy generation," *Proceedings of the IEEE*, vol. 111, no. 4, pp. 335–355, 2023.
- [34] M. S. Mahmoud, *Microgrid: advanced control methods and renewable energy system integration*. Elsevier, 2016.

- [35] Z.-S. Zhang, Y.-Z. Sun, J. Lin, and G.-J. Li, "Coordinated frequency regulation by doubly fed induction generator-based wind power plants," *IET Renewable Power Generation*, vol. 6, no. 1, pp. 38–47, 2012.
- [36] J. Fang, H. Li, Y. Tang, and F. Blaabjerg, "On the inertia of future more-electronics power systems," *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 7, no. 4, pp. 2130–2146, 2018.
- [37] M. F. M. Arani and E. F. El-Saadany, "Implementing virtual inertia in dfig-based wind power generation," *IEEE Transactions on Power Systems*, vol. 28, no. 2, pp. 1373–1384, 2012.
- [38] T. Shintai, Y. Miura, and T. Ise, "Oscillation damping of a distributed generator using a virtual synchronous generator," *IEEE transactions on power delivery*, vol. 29, no. 2, pp. 668–676, 2014.
- [39] M. Chen, D. Zhou, and F. Blaabjerg, "Modelling, implementation, and assessment of virtual synchronous generator in power systems," *Journal of Modern Power Systems and Clean Energy*, vol. 8, no. 3, pp. 399–411, 2020.
- [40] P. Utkarsha, N. S. Naidu, B. Sivaprasad, and K. A. Singh, "A flexible virtual inertia and damping control strategy for virtual synchronous generator for effective utilization of energy storage," *IEEE Access*, 2023.
- [41] P. Utkarsha and N. S. Naidu, "Virtual synchronous machine based electric vehicle charger for meeting ancillary services," in *2019 IEEE Transportation Electrification Conference (ITEC-India)*. IEEE, 2019, pp. 1–6.
- [42] K. M. Cheema, "A comprehensive review of virtual synchronous generator," *International journal of electrical power & energy systems*, vol. 120, p. 106006, 2020.
- [43] Q.-C. Zhong and G. Weiss, "Synchronverters: Inverters that mimic synchronous generators," *IEEE transactions on industrial electronics*, vol. 58, no. 4, pp. 1259–1267, 2010.
- [44] V. L. Srinivas, B. Singh, and S. Mishra, "Self-synchronizing vsm with seamless operation during unintentional islanding events," *IEEE Transactions on Industrial Informatics*, vol. 16, no. 9, pp. 5680–5690, 2019.

- [45] A. B. Shitole, H. M. Suryawanshi, G. G. Talapur, S. Sathyan, M. S. Ballal, V. B. Borghate, M. R. Ramteke, and M. A. Chaudhari, “Grid interfaced distributed generation system with modified current control loop using adaptive synchronization technique,” *IEEE Transactions on Industrial Informatics*, vol. 13, no. 5, pp. 2634–2644, 2017.
- [46] V. L. Srinivas, S. Kumar, B. Singh, and S. Mishra, “A normalized adaptive filter for enhanced optimal operation of grid-interfaced pv system,” *IEEE Transactions on Industry Applications*, vol. 57, no. 2, pp. 1715–1724, 2020.
- [47] M. M. Islam, K. M. Muttaqi, D. Sutanto, M. M. Rahman, and O. Alonso, “Design of a controller for grid forming inverter-based power generation systems,” *IEEE Access*, 2023.
- [48] V. L. Srinivas, B. Singh, and S. Mishra, “Seamless mode transition technique for virtual synchronous generators and method thereof,” *IEEE Transactions on Industrial Informatics*, vol. 16, no. 8, pp. 5254–5266, 2019.
- [49] M. Ashabani and J. Jung, “Synchronous voltage controllers: Voltage-based emulation of synchronous machines for the integration of renewable energy sources,” *IEEE Access*, vol. 8, pp. 49 497–49 508, 2020.
- [50] J. L. Rodríguez-Amenedo, S. A. Gómez, M. Zubiaga, P. Izurza-Moreno, J. Arza, and J. D. Fernández, “Grid-forming control of voltage source converters based on the virtual-flux orientation,” *IEEE Access*, vol. 11, pp. 10 254–10 274, 2023.
- [51] H. Wu, X. Ruan, D. Yang, X. Chen, W. Zhao, Z. Lv, and Q.-C. Zhong, “Small-signal modeling and parameters design for virtual synchronous generators,” *IEEE Transactions on Industrial Electronics*, vol. 63, no. 7, pp. 4292–4303, 2016.
- [52] M. Schweizer, S. Almér, S. Pettersson, A. Merkert, V. Bergemann, and L. Harnefors, “Grid-forming vector current control,” *IEEE Transactions on Power Electronics*, vol. 37, no. 11, pp. 13 091–13 106, 2022.
- [53] Z. Li, C. Zang, P. Zeng, H. Yu, and S. Li, “Fully distributed hierarchical control of parallel grid-supporting inverters in islanded ac microgrids,” *IEEE Transactions on Industrial Informatics*, vol. 14, no. 2, pp. 679–690, 2017.

- [54] Q.-C. Zhong, G. C. Konstantopoulos, B. Ren, and M. Krstic, “Improved synchronverters with bounded frequency and voltage for smart grid integration,” *IEEE Transactions on Smart Grid*, vol. 9, no. 2, pp. 786–796, 2016.
- [55] A. Tayyebi, D. Groß, A. Anta, F. Kupzog, and F. Dörfler, “Frequency stability of synchronous machines and grid-forming power converters,” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 8, no. 2, pp. 1004–1018, 2020.
- [56] W. Du, Z. Chen, K. P. Schneider, R. H. Lasseter, S. P. Nandanoori, F. K. Tuffner, and S. Kundu, “A comparative study of two widely used grid-forming droop controls on microgrid small-signal stability,” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 8, no. 2, pp. 963–975, 2019.
- [57] S. Kundu, M. Singh, and A. K. Giri, “Control algorithm for coordinated operation of wind-solar microgrid standalone generation system,” *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, vol. 44, no. 4, pp. 10 024–10 044, 2022.
- [58] S. .Kundu, M. Singh, and A. K. Giri, “Implementation of variable gain controller based improved phase locked loop approach to enhance power quality in autonomous microgrid,” *International Journal of Numerical Modelling: Electronic Networks, Devices and Fields*, vol. 36, no. 5, p. e3082, 2023.
- [59] S. Kundu, M. Singh, and A. K. Giri, “Adaptive control approach-based isolated microgrid system with alleviating power quality problems,” *Electric Power Components and Systems*, pp. 1–16, 2023.
- [60] S. .Kundu, M. Singh, and A. K. Giri, “Synchronization and control of wecs-spv-bss-based distributed generation system using iccf-pll control approach,” *Electric Power Systems Research*, vol. 226, p. 109919, 2024.
- [61] S. Kundu, M. Singh, and A. K. Giri, “Spv-wind-bes-based islanded electrical supply system for remote applications with power quality enhancement,” *Electrical Engineering*, pp. 1–16, 2023.
- [62] R. Teodorescu, M. Liserre, and P. Rodriguez, *Grid converters for photovoltaic and wind power systems*. John Wiley & Sons, 2011.

- [63] I. J. Balaguer, Q. Lei, S. Yang, U. Supatti, and F. Z. Peng, "Control for grid-connected and intentional islanding operations of distributed power generation," *IEEE transactions on industrial electronics*, vol. 58, no. 1, pp. 147–157, 2010.
- [64] Q.-C. Zhong and T. Hornik, *Control of power inverters in renewable energy and smart grid integration*. John Wiley & Sons, 2012.
- [65] F. Blaabjerg, R. Teodorescu, M. Liserre, and A. V. Timbus, "Overview of control and grid synchronization for distributed power generation systems," *IEEE Transactions on industrial electronics*, vol. 53, no. 5, pp. 1398–1409, 2006.
- [66] T.-V. Tran, T.-W. Chun, H.-H. Lee, H.-G. Kim, and E.-C. Nho, "PLL-based seamless transfer control between grid-connected and islanding modes in grid-connected inverters," *IEEE Transactions on Power Electronics*, vol. 29, no. 10, pp. 5218–5228, 2013.
- [67] J. Wang, N. C. P. Chang, X. Feng, and A. Monti, "Design of a generalized control algorithm for parallel inverters for smooth microgrid transition operation," *IEEE Transactions on Industrial Electronics*, vol. 62, no. 8, pp. 4900–4914, 2015.
- [68] C. Yang, L. Huang, H. Xin, and P. Ju, "Placing grid-forming converters to enhance small signal stability of pll-integrated power systems," *IEEE Transactions on Power Systems*, vol. 36, no. 4, pp. 3563–3573, 2020.
- [69] L. Huang, H. Xin, Z. Li, P. Ju, H. Yuan, Z. Lan, and Z. Wang, "Grid-synchronization stability analysis and loop shaping for pll-based power converters with different reactive power control," *IEEE Transactions on Smart Grid*, vol. 11, no. 1, pp. 501–516, 2019.
- [70] J. Svensson, "Synchronisation methods for grid-connected voltage source converters," *IEE Proceedings-Generation, Transmission and Distribution*, vol. 148, no. 3, pp. 229–235, 2001.
- [71] M. Ciobotaru, R. Teodorescu, and F. Blaabjerg, "A new single-phase pll structure based on second order generalized integrator," in *2006 37th IEEE Power Electronics Specialists Conference*. IEEE, 2006, pp. 1–6.

- [72] Q.-C. Zhong, P.-L. Nguyen, Z. Ma, and W. Sheng, "Self-synchronized synchronverters: Inverters without a dedicated synchronization unit," *IEEE Transactions on power electronics*, vol. 29, no. 2, pp. 617–630, 2013.
- [73] J. Liu, M. Hossain, and J. Lu, "Switching performance optimization for a hybrid ac/dc microgrid using an improved vsg control strategy," in *2017 IEEE Innovative Smart Grid Technologies-Asia (ISGT-Asia)*. IEEE, 2017, pp. 1–5.
- [74] R. Hariharan and M. K. Mishra, "An inbuilt synchronization controller for three-phase synchronverters," in *2018 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES)*. IEEE, 2018, pp. 1–6.
- [75] S. Dong and Y. C. Chen, "Adjusting synchronverter dynamic response speed via damping correction loop," *IEEE Transactions on Energy Conversion*, vol. 32, no. 2, pp. 608–619, 2016.
- [76] M. N. Arafat, A. Elrayyah, and Y. Sozer, "An effective smooth transition control strategy using droop-based synchronization for parallel inverters," *IEEE Transactions on Industry Applications*, vol. 51, no. 3, pp. 2443–2454, 2014.
- [77] J. Wang, N. Ramli, and N. H. A. Aziz, "Pre synchronization control strategy of virtual synchronous generator (vsg) in micro-grid," *IEEE Access*, 2023.
- [78] M. Li, Y. Wang, Y. Liu, N. Xu, S. Shu, and W. Lei, "Enhanced power decoupling strategy for virtual synchronous generator," *IEEE Access*, vol. 8, pp. 73 601–73 613, 2020.
- [79] K. Li, P. Cheng, L. Wang, X. Tian, J. Ma, and L. Jia, "Improved active power control of virtual synchronous generator for enhancing transient stability," *IET Power Electronics*, vol. 16, no. 1, pp. 157–167, 2023. [Online]. Available: <https://ietresearch.onlinelibrary.wiley.com/doi/abs/10.1049/pel2.12371>
- [80] N. Xu, Y. Wang, M. Li, W. Wang, N. Wang, and J. Li, "An optimal control method of virtual angular acceleration to improve transient response based on virtual synchronous generator," in *2017 IEEE 3rd International Future Energy Electronics Conference and ECCE Asia (IFEEEC 2017 - ECCE Asia)*, 2017, pp. 1559–1563.

- [81] Y. Xiang-zhen, S. Jian-hui, D. Ming, L. Jin-wei, and D. Yan, "Control strategy for virtual synchronous generator in microgrid," in *2011 4th International Conference on Electric Utility Deregulation and Restructuring and Power Technologies (DRPT)*, 2011, pp. 1633–1637.
- [82] J. Alipoor, Y. Miura, and T. Ise, "Power system stabilization using virtual synchronous generator with alternating moment of inertia," *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 3, no. 2, pp. 451–458, 2015.
- [83] S. Wang, R. Qi, and Y. Li, "Fuzzy control scheme of virtual inertia for synchronverter in micro-grid," in *2018 21st International Conference on Electrical Machines and Systems (ICEMS)*, 2018, pp. 2028–2032.
- [84] Y. Shao, C. Zhu, S. Dong, and Y. Xu, "Adaptive damping coefficient control of virtual synchronous generator of microgrid inverter," in *2019 29th Australasian Universities Power Engineering Conference (AUPEC)*, 2019, pp. 1–6.
- [85] M. A. Torres L., L. A. C. Lopes, L. A. Morán T., and J. R. Espinoza C., "Self-tuning virtual synchronous machine: A control strategy for energy storage systems to support dynamic frequency control," *IEEE Transactions on Energy Conversion*, vol. 29, no. 4, pp. 833–840, 2014.
- [86] R. Shi, X. Zhang, C. Hu, H. Xu, J. Gu, and W. Cao, "Self-tuning virtual synchronous generator control for improving frequency stability in autonomous photovoltaic-diesel microgrids," *Journal of Modern Power Systems and Clean Energy*, vol. 6, no. 3, pp. 482–494, 2018.
- [87] F. Wang, L. Zhang, X. Feng, and H. Guo, "An adaptive control strategy for virtual synchronous generator," *IEEE Transactions on Industry Applications*, vol. 54, no. 5, pp. 5124–5133, 2018.
- [88] X. Zhang, F. Mao, H. Xu, F. Liu, and M. Li, "An optimal coordination control strategy of micro-grid inverter and energy storage based on variable virtual inertia and damping of vsgr," *Chinese Journal of Electrical Engineering*, vol. 3, no. 3, pp. 25–33, 2017.

- [89] A. S. Mir and N. Senroy, "Self-tuning neural predictive control scheme for ultra-battery to emulate a virtual synchronous machine in autonomous power systems," *IEEE Transactions on Neural Networks and Learning Systems*, vol. 31, no. 1, pp. 136–147, 2020.
- [90] F. Yao, J. Zhao, X. Li, L. Mao, and K. Qu, "Rbf neural network based virtual synchronous generator control with improved frequency stability," *IEEE Transactions on Industrial Informatics*, vol. 17, no. 6, pp. 4014–4024, 2021.
- [91] Z. Wang, Y. Yu, W. Gao, M. Davari, and C. Deng, "Adaptive, optimal, virtual synchronous generator control of three-phase grid-connected inverters under different grid conditions—an adaptive dynamic programming approach," *IEEE Transactions on Industrial Informatics*, vol. 18, no. 11, pp. 7388–7399, 2022.
- [92] M. Yang, Y. Wang, X. Xiao, and Y. Li, "A robust damping control for virtual synchronous generators based on energy reshaping," *IEEE Transactions on Energy Conversion*, vol. 38, no. 3, pp. 2146–2159, 2023.
- [93] N. Hatziargyriou, *Microgrids: architectures and control*. John Wiley & Sons, 2014.
- [94] Z. Zheng, Z. Rongxiang, and T. Shengqing, "Research review on advanced grid-connected inverter for renewable energy distributed access," *Chinese journal of electrical engineering*, vol. 33, no. 24, pp. 1–12, 2013.
- [95] V. L. Srinivas, B. Singh, and S. Mishra, "Fault ride-through strategy for two-stage grid-connected photovoltaic system enabling load compensation capabilities," *IEEE Transactions on industrial electronics*, vol. 66, no. 11, pp. 8913–8924, 2019.
- [96] H. Beltran, E. Bilbao, E. Belenguer, I. Etxeberria-Otadui, and P. Rodriguez, "Evaluation of storage energy requirements for constant production in pv power plants," *IEEE transactions on industrial electronics*, vol. 60, no. 3, pp. 1225–1234, 2012.
- [97] S. Chen, T. Zhang, H. B. Gooi, R. D. Masiello, and W. Katzenstein, "Penetration rate and effectiveness studies of aggregated bess for frequency regulation," *IEEE Transactions on Smart Grid*, vol. 7, no. 1, pp. 167–177, 2015.

- [98] M. M. Hasan, S. Jaman, T. Geury, and O. Hegazy, "Design and simulation of a grid-connected two-stage bidirectional converter for a combined pv-stationary energy storage system," in *2022 Second International Conference on Sustainable Mobility Applications, Renewables and Technology (SMART)*. IEEE, 2022, pp. 1–8.
- [99] N. F. Ibrahim, M. M. Mahmoud, A. M. Al Thaiban, A. B. Barnawi, Z. S. Elbarbary, A. I. Omar, and H. Abdelfattah, "Operation of grid-connected pv system with ann-based mppt and an optimized lcl filter using grg algorithm for enhanced power quality," *IEEE Access*, 2023.
- [100] S. Mishra, D. Pullaguram, S. Achary Buragappu, and D. Ramasubramanian, "Single-phase synchronverter for a grid-connected roof top photovoltaic system," *IET Renewable Power Generation*, vol. 10, no. 8, pp. 1187–1194, 2016.
- [101] X. Quan, R. Yu, X. Zhao, Y. Lei, T. Chen, C. Li, and A. Q. Huang, "Photovoltaic synchronous generator: Architecture and control strategy for a grid-forming pv energy system," *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 8, no. 2, pp. 936–948, 2019.
- [102] H. Hasabelrasul, Z. Cai, L. Sun, X. Suo, and I. Matraji, "Two-stage converter standalone pv-battery system based on vsg control," *IEEE Access*, vol. 10, pp. 39 825–39 832, 2022.
- [103] Y. Liu, Y. Wang, M. Wang, Z. Xu, Y. Peng, and M. Li, "Coordinated vsg control of photovoltaic/battery system for maximum power output and grid supporting," *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*, vol. 12, no. 1, pp. 301–309, 2022.
- [104] M. Alanazi, M. Salem, M. H. Sabzalian, N. Prabakaran, S. Ueda, and T. Senjyu, "Designing a new controller in the operation of the hybrid pv-bess system to improve the transient stability," *IEEE Access*, 2023.
- [105] S. A. Khajehoddin, M. Karimi-Ghartemani, and M. Ebrahimi, "Grid-supporting inverters with improved dynamics," *IEEE Transactions on Industrial Electronics*, vol. 66, no. 5, pp. 3655–3667, 2018.

- [106] A. J. Sonawane and A. C. Umarikar, “Small-signal stability analysis of pv-based synchronverter including pv operating modes and dc-link voltage controller,” *IEEE Transactions on Industrial Electronics*, vol. 69, no. 8, pp. 8028–8039, 2021.
- [107] J. M. Guerrero, P. C. Loh, T.-L. Lee, and M. Chandorkar, “Advanced control architectures for intelligent microgrids—part ii: Power quality, energy storage, and ac/dc microgrids,” *IEEE Transactions on industrial electronics*, vol. 60, no. 4, pp. 1263–1270, 2012.
- [108] B. Singh, A. Chandra, and K. Al-Haddad, *Power quality: problems and mitigation techniques*. John Wiley & Sons, 2014.
- [109] J. Hu, Y. Shan, K. W. Cheng, and S. Islam, “Overview of power converter control in microgrids—challenges, advances, and future trends,” *IEEE Transactions on Power Electronics*, vol. 37, no. 8, pp. 9907–9922, 2022.
- [110] S. Elphick, P. Ciufu, G. Drury, V. Smith, S. Perera, and V. Gosbell, “Large scale proactive power-quality monitoring: An example from australia,” *IEEE Transactions on Power Delivery*, vol. 32, no. 2, pp. 881–889, 2016.
- [111] J. Wang, K. Sun, H. Wu, L. Zhang, J. Zhu, and Y. Xing, “Quasi-two-stage multifunctional photovoltaic inverter with power quality control and enhanced conversion efficiency,” *IEEE Transactions on Power Electronics*, vol. 35, no. 7, pp. 7073–7085, 2019.
- [112] I. Khan, A. Vijay, and S. Doolla, “Nonlinear load harmonic mitigation strategies in microgrids: State of the art,” *IEEE Systems Journal*, vol. 16, no. 3, pp. 4243–4255, 2021.
- [113] N. Abas, S. Dilshad, A. Khalid, M. S. Saleem, and N. Khan, “Power quality improvement using dynamic voltage restorer,” *IEEE Access*, vol. 8, pp. 164 325–164 339, 2020.
- [114] R. Ni, Y. W. Li, Y. Zhang, N. R. Zargari, and Z. Cheng, “Virtual impedance-based selective harmonic compensation (vi-shc) pwm for current source rectifiers,” *IEEE transactions on power electronics*, vol. 29, no. 7, pp. 3346–3356, 2013.

- [115] T. A. Naidu, S. R. Arya, R. Maurya, and S. Padmanaban, "Performance of dvr using optimized pi controller based gradient adaptive variable step lms control algorithm," *IEEE Journal of Emerging and Selected Topics in Industrial Electronics*, vol. 2, no. 2, pp. 155–163, 2021.
- [116] A. Y. Goharrizi, S. H. Hosseini, M. Sabahi, and G. B. Gharehpetian, "Three-phase hfl-dvr with independently controlled phases," *IEEE transactions on power electronics*, vol. 27, no. 4, pp. 1706–1718, 2011.
- [117] S. Ziaeinejad and A. Mehrizi-Sani, "Design tradeoffs in selection of the dc-side voltage for a d-statcom," *IEEE Transactions on Power Delivery*, vol. 33, no. 6, pp. 3230–3232, 2017.
- [118] X. Ge and F. Gao, "Flexible third harmonic voltage control of low capacitance cascaded h-bridge statcom," *IEEE Transactions on Power Electronics*, vol. 33, no. 3, pp. 1884–1889, 2017.
- [119] H. Akagi, "New trends in active filters for power conditioning," *IEEE transactions on industry applications*, vol. 32, no. 6, pp. 1312–1322, 1996.
- [120] H. Fujita and H. Akagi, "The unified power quality conditioner: the integration of series- and shunt-active filters," *IEEE Transactions on Power Electronics*, vol. 13, no. 2, pp. 315–322, 1998.
- [121] V. Khadkikar, "Enhancing electric power quality using upqc: A comprehensive overview," *IEEE transactions on Power Electronics*, vol. 27, no. 5, pp. 2284–2297, 2011.
- [122] R. M. Abdalaal and C. N. M. Ho, "Analysis and validations of modularized distributed tl-upqc systems with supervisory remote management system," *IEEE Transactions on Smart Grid*, vol. 12, no. 3, pp. 2638–2651, 2020.
- [123] J. Han, X. Li, Y. Sun, D. Luo, and S. Huang, "Optimal operation of upqc under va capacity constraints based on hierarchical optimization," *International Journal of Electrical Power & Energy Systems*, vol. 122, p. 106168, 2020.

- [124] J. Ye, H. B. Gooi, and F. Wu, "Optimal design and control implementation of upqc based on variable phase angle control method," *IEEE Transactions on Industrial Informatics*, vol. 14, no. 7, pp. 3109–3123, 2018.
- [125] P. E. Melín, J. R. Espinoza, L. A. Morán, J. R. Rodriguez, V. M. Cardenas, C. R. Baier, and J. A. Muñoz, "Analysis, design and control of a unified power-quality conditioner based on a current-source topology," *IEEE transactions on power delivery*, vol. 27, no. 4, pp. 1727–1736, 2012.
- [126] V. S.-P. Cheung, R. S.-C. Yeung, H. S.-H. Chung, A. W.-L. Lo, and W. Wu, "A transformer-less unified power quality conditioner with fast dynamic control," *IEEE Transactions on Power Electronics*, vol. 33, no. 5, pp. 3926–3937, 2017.
- [127] Q. Xu, F. Ma, A. Luo, Z. He, and H. Xiao, "Analysis and control of m3c-based upqc for power quality improvement in medium/high-voltage power grid," *IEEE Transactions on Power Electronics*, vol. 31, no. 12, pp. 8182–8194, 2016.
- [128] T. Koroglu, A. Tan, M. M. Savrun, M. U. Cuma, K. C. Bayindir, and M. Tumay, "Implementation of a novel hybrid upqc topology endowed with an isolated bidirectional dc–dc converter at dc link," *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 8, no. 3, pp. 2733–2746, 2019.
- [129] A. M. Rauf, A. V. Sant, V. Khadkikar, and H. Zeineldin, "A novel ten-switch topology for unified power quality conditioner," *IEEE Transactions on power electronics*, vol. 31, no. 10, pp. 6937–6946, 2015.
- [130] R. J. M. dos Santos, J. C. da Cunha, and M. Mezaroba, "A simplified control technique for a dual unified power quality conditioner," *IEEE Transactions on Industrial Electronics*, vol. 61, no. 11, pp. 5851–5860, 2014.
- [131] V. Khadkikar and A. Chandra, "Upqc-s: A novel concept of simultaneous voltage sag/swell and load reactive power compensations utilizing series inverter of upqc," *IEEE transactions on power electronics*, vol. 26, no. 9, pp. 2414–2425, 2011.
- [132] B. B. Ambati and V. Khadkikar, "Optimal sizing of upqc considering va loading and maximum utilization of power-electronic converters," *IEEE transactions on power delivery*, vol. 29, no. 3, pp. 1490–1498, 2014.

- [133] S. B. Karanki, N. Geddada, M. K. Mishra, and B. K. Kumar, "A modified three-phase four-wire upqc topology with reduced dc-link voltage rating," *IEEE transactions on industrial electronics*, vol. 60, no. 9, pp. 3555–3566, 2012.
- [134] L. Meng, L. Ma, W. Zhu, H. Yan, T. Wang, W. Mao, X. He, and Z. Shu, "Control strategy of single-phase upqc for suppressing the influences of low-frequency dc-link voltage ripple," *IEEE Transactions on Power Electronics*, vol. 37, no. 2, pp. 2113–2124, 2021.
- [135] R. A. Modesto, S. A. O. da Silva, A. A. de Oliveira, and V. D. Bacon, "A versatile unified power quality conditioner applied to three-phase four-wire distribution systems using a dual control strategy," *IEEE Transactions on Power Electronics*, vol. 31, no. 8, pp. 5503–5514, 2015.
- [136] A. K. Giri, S. R. Arya, and R. Maurya, "Compensation of power quality problems in wind-based renewable energy system for small consumer as isolated loads," *IEEE Transactions on Industrial Electronics*, vol. 66, no. 11, pp. 9023–9031, 2018.
- [137] S. Devassy and B. Singh, "Design and performance analysis of three-phase solar pv integrated upqc," *IEEE Transactions on Industry Applications*, vol. 54, no. 1, pp. 73–81, 2017.
- [138] N. Saxena, I. Hussain, B. Singh, and A. L. Vyas, "Implementation of a grid-integrated pv-battery system for residential and electrical vehicle applications," *IEEE transactions on industrial electronics*, vol. 65, no. 8, pp. 6592–6601, 2017.
- [139] V. Rallabandi, O. M. Akeyo, N. Jewell, and D. M. Ionel, "Incorporating battery energy storage systems into multi-mw grid connected pv systems," *IEEE Transactions on Industry Applications*, vol. 55, no. 1, pp. 638–647, 2018.
- [140] L. B. G. Campanhol, S. A. O. Da Silva, A. A. De Oliveira, and V. D. Bacon, "Power flow and stability analyses of a multifunctional distributed generation system integrating a photovoltaic system with unified power quality conditioner," *IEEE Transactions on Power Electronics*, vol. 34, no. 7, pp. 6241–6256, 2018.
- [141] S. R. Ghatak, S. Sannigrahi, and P. Acharjee, "Multi-objective approach for strategic incorporation of solar energy source, battery storage system, and dstatcom in

- a smart grid environment,” *IEEE Systems Journal*, vol. 13, no. 3, pp. 3038–3049, 2018.
- [142] K. K. Prasad, H. Myneni, and G. S. Kumar, “Power quality improvement and pv power injection by dstatcom with variable dc link voltage control from rsc-mlc,” *IEEE Transactions on Sustainable Energy*, vol. 10, no. 2, pp. 876–885, 2018.
- [143] S. Devassy and B. Singh, “Performance analysis of solar pv array and battery integrated unified power quality conditioner for microgrid systems,” *IEEE Transactions on Industrial Electronics*, vol. 68, no. 5, pp. 4027–4035, 2020.
- [144] P.-L. Nguyen, Q.-C. Zhong, F. Blaabjerg, and J. M. Guerrero, “Synchronverter-based operation of statcom to mimic synchronous condensers,” in *2012 7th IEEE conference on industrial electronics and applications (ICIEA)*. IEEE, 2012, pp. 942–947.
- [145] G. Abad *et al.*, *Power electronics and electric drives for traction applications*. Wiley Online Library, 2017.
- [146] S. A. Rahman, R. K. Varma, and T. Vanderheide, “Generalised model of a photovoltaic panel,” *IET Renewable Power Generation*, vol. 8, no. 3, pp. 217–229, 2014.
- [147] G. Abad, J. Lopez, M. Rodriguez, L. Marroyo, and G. Iwanski, *Doubly fed induction machine: modeling and control for wind energy generation*. John Wiley & Sons, 2011.
- [148] D. Kothari and I. Nagrath, *Electric machines*. Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010, vol. 10, no. Z1.



# List of Publication

## Journals

- **Prateek Utkarsha**, N K Swami Naidu, Batta Sivaprasad, Kumar Abhishek Singh, “A Flexible Virtual Inertia and Damping Control Strategy for Virtual Synchronous Generator for Effective Utilization of Energy Storage”, *IEEE Access*, vol.11, pp. 124068-124080, 2023, doi: 10.1109/ACCESS.2023.3330237.
- **Prateek Utkarsha**, N K Swami Naidu, “Seamless transfer of virtual synchronous generator using virtual synchronizing torque controller”, *International Journal of Circuit Theory and Applications*, pp. 1-21, 2024. doi:10.1002/cta.4071.
- **Prateek Utkarsha**, N K Swami Naidu “Seamless Mode Control Algorithm for a Single-Stage Photovoltaic Virtual Synchronous Generator for Frequency Regulation and Reactive Power Support,” in *IEEE Journal of Emerging and Selected Topics in Industrial Electronics*. (Under Minor Revision)

## Conferences

- **P. Utkarsha** and N. K. S. Naidu, ”Virtual Synchronous Machine based Electric Vehicle charger for meeting Ancillary Services,” *2019 IEEE Transportation Electrification Conference (ITEC-India)*, Bengaluru, India, 2019, pp. 1-6, doi: 10.1109/ITEC-India48457.2019.ITECINDIA2019-48.
- **P. Utkarsha** and N. K. S. Naidu, ”Virtual Synchronizing Torque and Voltage Controller Based Grid Synchronization of Virtual Synchronous Generator,” *2022 IEEE 2nd International Conference on Sustainable Energy and Future Electric Transportation (SeFeT)*, Hyderabad, India, 2022, pp. 1-5, doi: 10.1109/SeFeT55524.2022.9909149.

- N. K. Swami Naidu, **P. Utkarsha** and N. Yalla, "Optimal Sizing and Minimizing the Volt Ampere Loading on UPQC Converters for Distributed Generation Applications," *2022 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES)*, Jaipur, India, 2022, pp. 1-6, doi: 10.1109/PEDES56012.2022.10080689.
- **P. Utkarsha**, N. K. Swami Naidu, B. Sivaprasad and N. Yalla, "Synchronverter based Multifunctional UPQC for Distributed Generation Applications," *2023 IEEE International Conference on Power Electronics, Smart Grid, and Renewable Energy (PESGRE)*, Trivandrum, India, 2023, pp. 1-6, doi: 10.1109/PESGRE58662.2023.10404945.