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Using Fuzzy Design and Control of Micro-Grid by Renewable Energy Generating Sources

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Abstract *– Increased penetration of distributed energy resources into conventional power systems increases control challenges. These can be suitably met by microgrids. This paper examines the architecture of microgrids and reviews their classifications and the literatures discussing their control objectives during islanded mode. It finds the use of microgrids enhancing the conventional power system's grid smartness. It also summarizes microgrid control objectives and their most common problems and solutions. We are design efficient architecture with different condition like no load with non linear load and control by fuzzy logic controller. Using fuzzy logic controller we get high quality output.*

Keywords*: Solar ,Wind ,Battery, Fuzzy Logic, Power Quality*

I. Introduction

An electrical system that includes multiple loads and distributed energy resources that can be operated in parallel with in the border utility grid is called micro grid. Many countries generate electricity in large centralized facilities; these plants have excellent economies of scale, but usually transmit electricity long distances and can negatively affect the environment. Distributed generation allows collection of energy from many sources and may give lower environmental impacts and improved security of supply. Distributed generation reduces the amount of energy lost in transmitting electricity because the electricity is generated very near where it is used, perhaps even in the same building. This also reduces the size and number of power lines that must be constructed. Micro grid generation resources can include fuel cells, Fuel Cell, solar, or other energy sources. In recent years, electricity generation by photovoltaic (PV) or Fuel Cell power (WP) has received considerable attention worldwide.[1] The combination of Fuel Cell and solar energy leads to reduced local storage requirements. The combination of battery energy storage system and super capacitor technologies in turn can form multilevel energy storage. The battery energy storage system employs for balancing the supply and demand where as super capacitor provides cache control to compensate for fast power fluctuations and smoothen the transients encountered by a battery with higher energy capacity. Micro grids or hybrid energy systems have been shown to be an effective structure for local interconnection of distributed renewable generation, loads and storage. With the ongoing and increasing demand for improved reliability and energy efficiency across all commercial buildings, a tremendous opportunity exists to capitalize on the benefits of DC micro grids.[6]

A Microgrid is a discrete energy system that consists of distributed energy sources and loads capable of operating in parallel. Thus, the generation, storage and demand management of power becomes easy. The primary purpose is to ensure local, reliable and flexible power for urban and rural communities, at the same time, providing solutions for commercial, industrial and federal government consumers. A microgrid also consists of distributed energy resources like solar PV systems and Fuel Cell energy systems that have several electrical loads.[8]

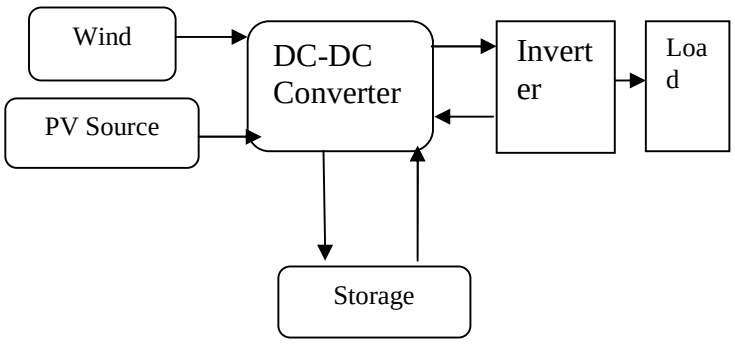


Figure.1. Grid-connected hybrid PV-Wind-battery based system

The matrix associated cross breed PV-Fuel Cell-battery based for the most part framework for family

applications, which may work either in total or network associated mode. This technique is fitting for oversee applications, where a modest, simple and minimal topology fit for self-ruling activity is fascinating. The focal point of the foreseen structure is that the multi-input transformer coupled bidirectional dc-dc convertor that interconnects distinctive power sources and in this way the limit part.

Hybrid PV-Wind primarily based generation of electricity and its interface with the ability grid area unit the necessary analysis areas. Chen et al. in [13], [14] have arranged a multi-input half breed PV-Fuel Cell control age framework that contains a buck/buck support intertwined multi-input dc-dc gadget and a full-connect dc air conditioning inverter. This structure is transcendently revolved around rising the Dc-interface voltage control. Inside the six-arm contraption topology Proposed by H. C. Chiang et al. [6], the yields of a PV gathering and wind generators district unit upheld to a lift gadget to arrange the dc-transport voltage. The reliable state execution of a system related cross breed PV and Fuel Cell structure with battery storing is inspected in [9]. This paper bases on system outlining, for instance, imperativeness creation, structure dependableness, unit size, and cost examination.

II. Method

A. Fuzzy Logic

Fuzzy logic has two different meanings. In a narrow sense, fuzzy logic is a logical system, which is an extension of multivalued logic. However, in a wider sense fuzzy logic (FL) is almost synonymous with the theory of fuzzy sets, a theory which relates to classes of objects with unsharp boundaries in which membership is a matter of degree. In this perspective, fuzzy logic in its narrow sense is a branch of FL. Even in its more narrow definition, fuzzy logic differs both in concept and substance from traditional multivalued logical systems. In Fuzzy Logic, fuzzy logic should be interpreted as FL, that is, fuzzy logic in its wide sense. The basic ideas underlying FL are explained in Foundations of Fuzzy Logic. What might be added is that the basic concept underlying FL is that of a linguistic variable, that is, a variable whose values are words rather than numbers. In effect, much of FL may be viewed as a methodology for computing with words rather than numbers. Although words are inherently less precise than numbers, their use is closer to human intuition. Furthermore, computing with words exploits the tolerance for imprecision and thereby lowers the cost of solution.

Another basic concept in FL, which plays a central role in most of its applications, is that of a fuzzy if-then rule or, simply, fuzzy rule. Although rule-based systems have a long history of use in Artificial Intelligence (AI), what is missing in such systems is a mechanism for dealing with fuzzy consequents and fuzzy antecedents. In fuzzy logic, this mechanism is provided by the calculus of fuzzy rules. The calculus of fuzzy rules serves as a basis for what might be called the Fuzzy Dependency and Command Language (FDCL). Although FDCL is not used explicitly in the toolbox, it is effectively one of its principal constituents. In most of the applications of fuzzy logic, a fuzzy logic solution is, in reality, a translation of a human solution into FDCL.

A trend that is growing in visibility relates to the use of fuzzy logic in combination with neurocomputing and genetic algorithms. More generally, fuzzy logic, neurocomputing, and genetic algorithms may be viewed as the principal constituents of what might be called soft computing. Unlike the traditional, hard computing, soft computing accommodates the imprecision of the real world.

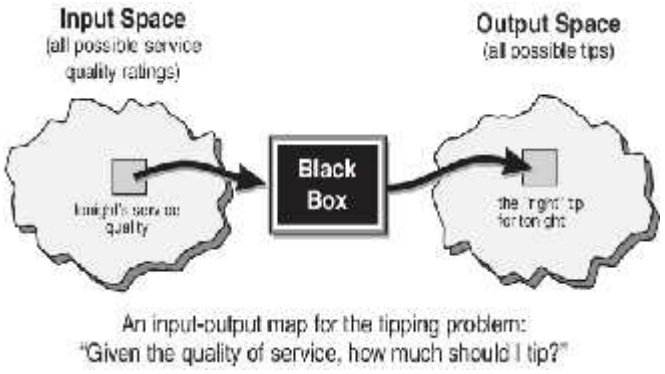


Figure:2 Fuzzy model

The guiding principle of soft computing is: Exploit the tolerance for imprecision, uncertainty, and partial truth to achieve tractability, robustness, and low solution cost. In the future, soft computing could play an increasingly important role in the conception and design of systems whose MIQ (Machine IQ) is much higher than that of systems designed by conventional methods.

Among various combinations of methodologies in soft computing, the one that has highest visibility at this juncture is that of fuzzy logic and neurocomputing, leading to neuro-fuzzy systems. Within fuzzy logic, such systems play a particularly important role in the induction of rules from observations.

III. Proposed Methodology

Here In this project Hybrid PV-wind based generation of electricity and its interface with the power grid are the important research areas. The proposed multi-input hybrid PV-Wind power generation system which has a buck/buck boost fused multi-input dc-dc converter and a full-bridge dc-ac inverter. This system is mainly focused on improving the dc-link voltage regulation. In the six-

arm converter topology proposed .The outputs of a PV array and Wind generators are fed to a boost converter to match the dc-bus voltage. The steady-state performance of a grid connected hybrid PV and Wind system with battery storage is analyzed.

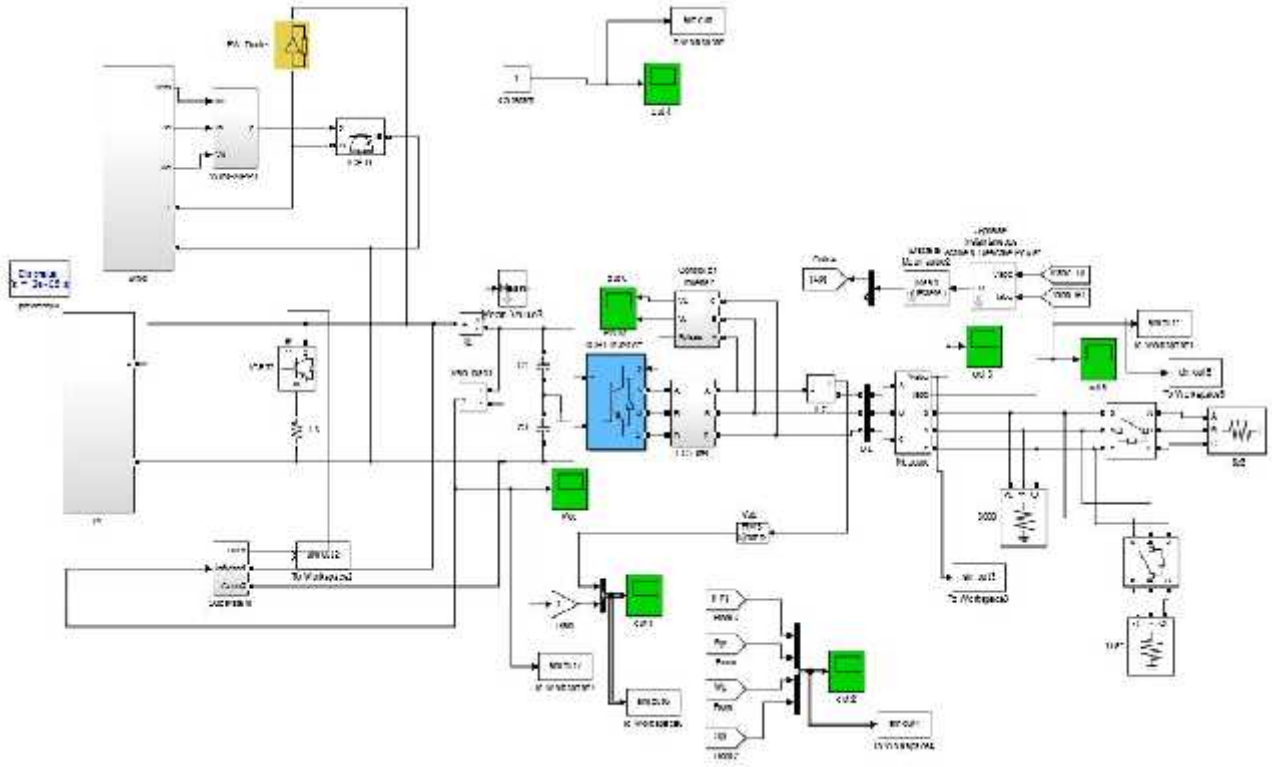


Figure: 3 Proposed Model

The grid connected hybrid PV-Wind-battery based system for family unit applications, which can work either in remain solitary system associated mode. This system is appropriate for family applications, where a minimal effort, basic and conservative topology equipped for independent activity is attractive. The center of the proposed system is the multi-input transformer coupled bidirectional dc-dc converter that interconnects different power sources and the capacity component.

The proposed converter comprises of a transformer coupled boost double half-connect bidirectional converter intertwined with bidirectional buck boost converter and a solitary stage full-connect inverter. The proposed converter has decreased number of intensity transformation stages with less part compute and high proficiency contrasted with the current grid connected plans.

The topology is basic and needs just six power switches. The boost double half-connect converter has two dc-interfaces on both sides of the high recurrence transformer. Controlling the voltage of one of the dc-joins guarantees controlling the voltage of the other. This makes the control methodology basic. Besides, extra converters can be coordinated with any of the two dc-joins. A bidirectional buck-support dc-dc converter is coordinated with the essential side dc-interface and single-phase full-connect bidirectional converter is associated with the dc-connection of the optional side.

The main components of hybrid are mini-hydro, solar cell, Wind energy, Wind and energy storage system. These are integrated for electricity generation, energy storage, and a load that normally operates connected to a main grid (macro grid). Hybrid can operate in two modes: one is grid-connected and the other is stand-alone mode. The main benefit of hybrid is that it can operate in standalone mode or main grid disconnection mode. The hybrid can then function autonomously. Generation and loads in a hybrid are usually interconnected at low voltage. But one issue related to hybrid is that operator should be very vigilant because numbers of power system are connected to hybrid. In the past, there was single entity to control.

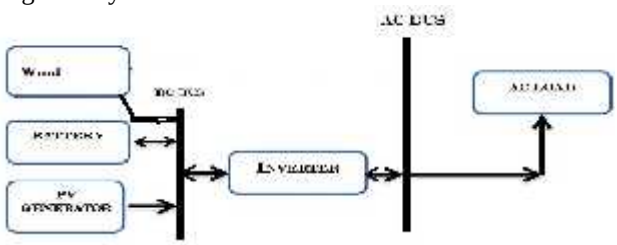
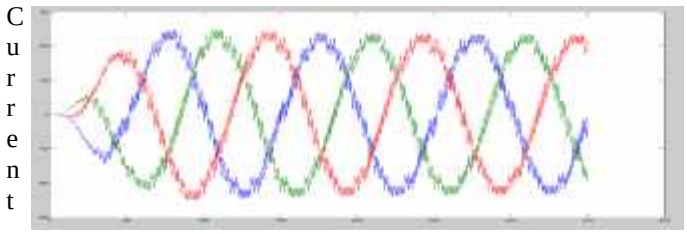


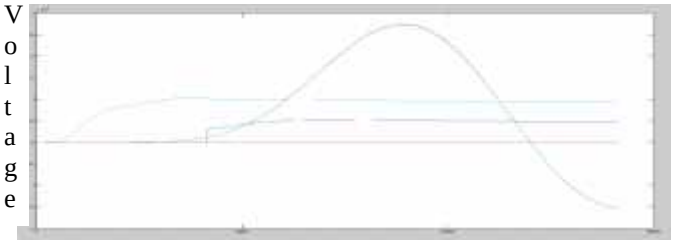
Figure 4. PV-Wind hybrid system.

IV. Simulation Results

This is result section for proposed model. Here we are analysis our proposed architecture design and Result with different operation like source variation and load variation.



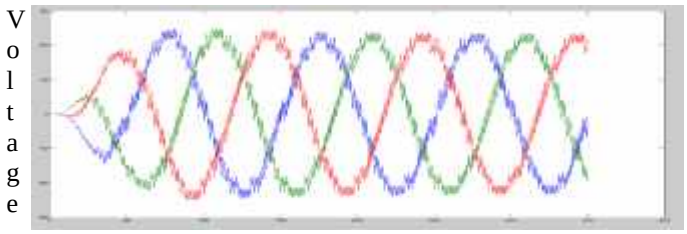
(a) Current



(b) Vdc

Figure 5 Model Simulation with PV

Figure 5 is show simulation result when PV is connected with linear load. Here we get content amplitude some initial time.

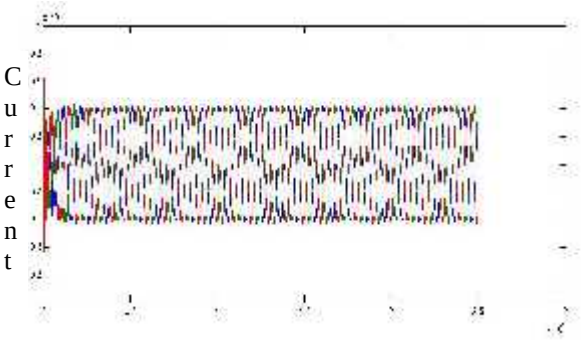


(a) Voltage

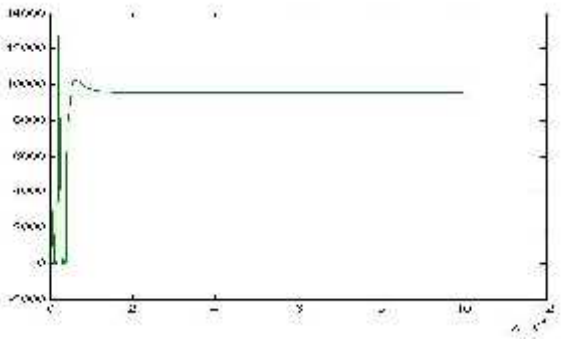
(b) Vdc

Figure 6: Model with PV and Wind

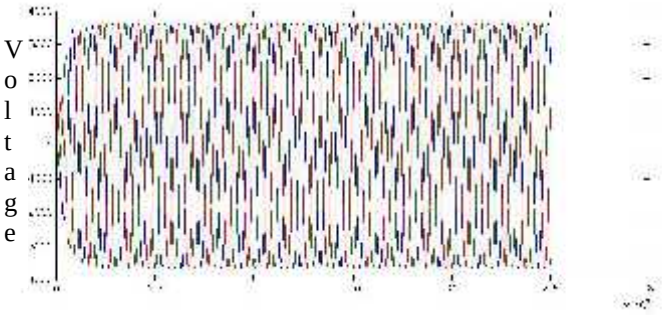
Figure 6 is show simulation result when PV and wind is connected with linear load. Here we get content amplitude some initial time.



(a) Current



(b) Battery Operation



(c) Voltage

Figure 7: PV and Wind With Non Linear Load

Figure 7 is show simulation result when PV and wind is connected with non linear load. Here we get content amplitude some initial time.

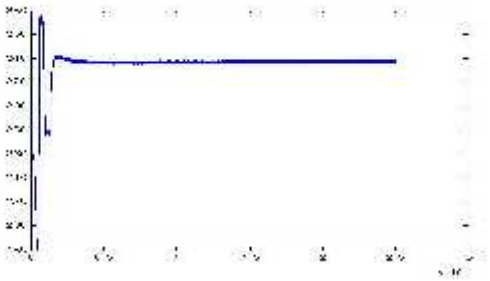


Figure 8: Battery Operation With non linear load

Figure 8 is show simulation result when PV and wind is connected with linear load. Here we show battery utility like voltage, current and state of charge(soc)

V. Conclusion

This paper basically focus wide range variable speed operation, especially at low-speed condition is obtained. At low irradiance , solar voltage is dropped due to V/f strategy and a boost converter is used to increase the voltage level to meet the higher and constant voltage requirement, such as in voltage source converter DC-link or offshore DC network applications. In the proposed topology fuzzy is controlled voltage and current variation of model and control excitation of wind. here we optimized conversion ration and power quality.

REFERENCES

[1] 1) T. Markvart, "Estimating of half and half photovoltaic-wind vitality frameworks," Solar Energy, Vol. 57, No.4, pp.277-281, 1996.
[2]
[3] 2) R. Ramakumar, I. Abouzahr, K. Ashenayi, "An information based way to deal with the plan of coordinated sustainable power source frameworks," IEEE Trans. Vitality Conversion, vol. 7, pp. 648-659, Dec. 1992.
[4]
[5] 3) Kaushik Rajashekara, "Mixture Wind Strategies for Clean Power Generation," IEEE Transactions on Industry Applications, Vol. 41, No. 3, May/June 2005.
[6]
[7] 4) O. C. Onar, M. Unzooglu, M.S.Alam,"Dynamic demonstrating, plan and recreation of a breeze/energy component/ultra-capacitor-based crossover control age framework," Journal of Power Sources,2006, vol. 161, pp. 707-722.
[8]
[9] 5) H. De Battista, R.J. Mantz, F. Garelli, "Power molding for a breeze hydrogen vitality framework," J. Power Sources, vol. 155, No. 2, 2006, pp. 478-486.
[10]
[11] 6) B. Delfino, F. Fornari, "Demonstrating and control of a coordinated energy component wind turbine framework," in Proceedings of the IEEE Power Tech Conference, Bologna, vol. 2, 2003, p. 6.
[12]
[13] 7) E.S. Abdin, W. Xu, "Control plan, and dynamic execution investigation of a breeze turbine-enlistment, generator unit," IEEE Trans. on Energy Conversion, vol. 15, no. 1, pp. 91-96, 2000.
[14]
[15] 8) E. Muljadi, C.P. Butterfield, "Pitch-controlled variable-speed wind turbine age," IEEE Trans. Industry Appl. vol.37, No.1, pp. 240-246, 2001.
[16]
[17] 9) M.J. Khan, M.T. Iqbal, "Dynamic demonstrating and recreation, of a little wind power module mixture vitality framework," J. Sustainable power source, vol. 30, no. 3, pp. 421-439, 2005.
[18]
[19] 10) D. B. Nelson, M. H. Nehrir, C. Wang, "Unit Sizing and cost Analysis of independent cross breed wind/PV/energy unit control age frameworks," J. Sustainable power source, no. 31, pp.1641-1656, 2006.
[20]
[21] 11) Hossain, Md Kamal, and Mohd Hasan Ali. "Fuzzy logic controlled power balancing for low voltage ride-through capability enhancement of large-scale grid-connected PV plants." Power and Energy Conference (TPEC), IEEE Texas. IEEE, 2017.
[22] 12) Hasanien, Hany M. "An adaptive control strategy for low voltage ride through capability enhancement of grid-connected photovoltaic power plants." IEEE Transactions on Power Systems 31.4 (2016): 3230-3237.
[23] 13) Yang, Yongheng, Frede Blaabjerg, and Huai Wang. "Low-voltage ride-through of single-phase transformerless photovoltaic inverters." IEEE Trans. Ind. Appl 50.3 (2014): 1942-1952.
[24] 14) H. C. Chiang, T. T. Ma, Y. H. Cheng, J. M. Chang, and W. N. Chang,"Design and implementation of a hybrid regenerative power system combining grid-tie and uninterruptible power supply functions,"IET Renew. Power Gen., vol. 4, no. 1, pp. 8599, (2010)
[25] 15) A. Khaligh, J. Cao, and Y. J. Lee, "A multiple-input dc-dc converter topology," IEEE Trans. Power Electron., vol. 24, no. 3, pp. 862-868,Mar. (2009)
[26] 16) P.Anesh Kumar*1, B.Ramesh2"Hybrid Source Based Transformer Coupled Bidirectional Dc-Dc Converter for Domestic Applications" International Journal of Science Engineering and Advance Technology, IJSEAT, Vol. 5, Issue 4 ISSN 2321-6905 April (2017)
[27] 17) K. Sun, L. Zhang, Y. Xing, and J. M. Guerrero, "A Distributed control strategy based on DC bus signalling modular photovoltaic generation systems with battery energy storage," IEEE Trans. Power Electron,vol. 26, no. 10, pp. 3032–3045, Oct. (2011)
[28] 18) Michael S.Branicky "Introduction to Hybrid Systems" Department of Electrical Engineering and Computer Science Case Western Reserve University Cleveland, OH 44106,
[29] 19) R. H. Lasseter and P. Paigi, "Micro grid: A conceptual solution," in Proc. IEEE Power Electron. Spec. Conf., vol. 6, pp. 4285–4290. Jun. (2004)
[30] 20) H. Zhou, T. Bhattacharya, D. Tran, T. S. T. Siew, and A. M. Khambadkone, "Composite energy storage system involving battery and ultra capacitor with dynamic energy management in micro grid applications," IEEE Trans. Power Electron., vol. 26, no. 3, pp. 923–930, Mar. (2011)
[31] 21) Y. M. Chen, C. Cheng, and H. Wu,"Grid-connected hybrid PV / Wind power generation system with improved DC bus voltage regulation strategy, "in Proc. of Applied Power Electronics Conference and Exposition, (APEC), Texas, pp.1088-1094, Mar. (2006)
[32] 22) Y. M. Chen, Y. C. Liu, S. C. Hung, and C. S. Cheng, "Multi-input inverter for grid-connected hybrid PV/Wind power system," IEEE Trans.Power Electron., vol. 22, no. 3, pp. 1070-1077, May. (2007)
[33] 23) L. Kumar and S. Jain, "A multiple input dc-dc converter for interfacing of battery/ultra capacitor in EVs/HEVs/FCVs," in Proc. IEEE IICPE,pp. 1-6.(2012)
[34] 24) N.D. Kaushika (Ph.D), S.S. Bhatnagar Research Endowment Award (Hariom Ashram Prerit) for research in energy conservation in (1987).
[35] 25) H. Wu, P. Xu, H. Hu, Z. Zhao, and Y. Xing, "Multiple converters based on integration of full-bridge and bidirectional dc-dc topologies for renewable generation systems," IEEE Trans. Ind. Electron., vol. 61, no. 2, pp. 856-869, Feb. (2014).

[36] 26) W. Li, C. Xu, H. Luo, Y. Hu, X. He, and C. Xia, "Decoupling-Controlled Triport Composited DC/DC Converter for Multiple Energy Interface" IEEE Trans. Ind. Electron., vol. 62, no. 7, pp. 4504-4513, July (2015).

[37] 27) S. K. Kim, J. H. Jeon, C. H. Cho, J. B. Ahn, and S. H. Kwon,"Dynamic modeling and control of a grid-connected hybrid generation system with versatile power transfer,"IEEE Trans. Ind. Electron., vol. 55, no. 4, pp.1677-1688, Apr. (2008).

[38] 28) Y. A.-R. I. Mohamed, "Mitigation of converter-grid resonance, grid induced distortion, and parametric instabilities in converter-based distributed generation," IEEE Trans. Power Electron., vol. 26, no. 3, pp. 983– 996, Mar. (2011).