

RESUME



PRASHANT

B.Tech, M.Tech-JMI, New Delhi,
PhD(persuing)-JMI, New Delhi.
AMIE(IEI), Chartered Engineer(CE).

Educational Qualifications	Year	Institution / Board	CGPA / %
PhD entitled “Application of Intelligent Techniques for Decision Making in Advance Power System Operations” from December, 2017 to till date.	Submitting in April ,2022	JAMIA MILLIA ISLAMIA, NEW DELHI.	-
M.Tech- Electrical Power System Management (EPSM)	2015	JAMIA MILLIA ISLAMIA, NEW DELHI	9.01 / 10
B.Tech (Electrical Engineering)	2011	JSS ACADEMY OF TECHNICAL EDUCATION, NOIDA (UPTU)	70.70
12 th	2006	C.B.S.E	83.20
10 th	2004	C.B.S.E	81.00

WORK EXPERIENCE

1. Above 6.5 Years working experience as **Assistant Professor in Department of Electrical Engineering ,JSS Academy of Technical Education, Noida** from 10/08/2015 to till date in Research & Development Activities , Teaching and Engineering activities in the domain of Power System , Solar Energy and Electrical Engineering.

Area of Interest

Power System Configuration and Operations & Control ,Simulation Tools , SCADA/HMI Systems, Transmission and Distribution Automation, Communication Protocols, Restructuring and Deregulation of Power System and Power System Optimization ,Congestion Management, Economic Load Dispatch and Unit Commitment methods, Integration of Renewable and Sustainable Energy systems, Solar Photovoltaic Systems, Solar thermal, heating and cooling applications, Wind Energy Conversion Systems, Hydro-Electric Power Plants & Geo-thermal systems, Power System Analysis, Stability and Control, Power Quality, Smart Grid/Microrgrids and Application of Artificial Intelligent Techniques like Genetic Algorithm, Artificial Neural Network , Fuzzy Logic etc. in Power System Operations.

RESEARCH PUBLICATIONS

INTERNATIONAL JOURNALS

1. A.S Siddiqui, Prashant, ” Optimal Cumulative Cost Strategy for the Thermal-Solar Integrated Radial Distribution System with minimized Carbon Footprint for Sustainable Solution for Clean Energy”, **International Journal of Green Energy (SCI)** ,March, 2022, DOI: 10.1080/15435075.2022.2033245.
2. Prashant, Anwar Shahzad Siddiqui, Abhinav Saxena, “Optimal intelligent strategic LMP Solution and Effect of DG in Deregulated System for Congestion Management”, **International**

Transactions on Electrical Energy Systems(SCI), vol.31, issue 11, pp.1-51, Aug,2021, DOI: 10.1002/2050-7038.13040.

3. Anwar Shahzad Siddiqui, **Prashant**, “**Optimal location and sizing of conglomerate DG-FACTS using an artificial neural network and heuristic probability distribution methodology for modern power system operation**”, **Protection and Control of Modern Power Systems, (SCI)**,vol.7(9),pp.1-25,March,2022, DOI : 10.1186/s41601-022-00230-5.
4. **Prashant**, Anwar Shahzad Siddiqui, Md Sarwar , Ahmed Althobaiti, Sherif S. M. Ghoneim, “**Optimal Location and Sizing of Distributed Generators in Power System Network with Power Quality Enhancement using Fuzzy Logic controlled D-STATCOM**”, **Sustainability (SCI)** 2022, 14(6), 3305, <https://doi.org/10.3390/su14063305>.
5. **Prashant**, Anwar Shahzad Siddiqui, Satyam Bansal, Vidushi “ **An advance methodology for hybrid modelling and selection of grid integrated renewable energy [wind/solar] profile through proteus**”, “**International Journal of Recent Technology and Engineering**” (scopus journal) vol.8, issue-2S7, pp 429-434, July 2019, DOI: 10.35940/ijrte.B1079.0782S719.
6. Abhinav Saxena, G. Patil **Prashant et al** , “**Optimal load distribution of thermal generating units using Particle Swarm Optimization(PSO)**”, “**International Journal of Recent Technology and Engineering**” (scopus journal), vol-8, issue-2S7, pp 440-444, July 2019, DOI: 10.35940/ijrte.B1081.0782S719.
7. Kafeel Khan, A.S Siddiqui, **Prashant** , “**A Contemporary Method For Harmonics Suppression in Power System By Implementing Shunt Active Power Filter**”, **Journal of Critical Reviews (scopus journal)**, vol. 7, issue 19, Aug.2020, pp- 8331-8340, doi: 10.31838/jcr.07.19.940.
8. **Prashant** , A.S. Siddiqui, “**A Comprehensive Review on Various FACTS Devices and Application of Different AI Techniques In Their Operations For Progressive Electric Power System Operations**”, **International Journal of Computing and Digital Systems (scopus journal)**, (accepted) prepublished link - <https://journal.uob.edu.bh/handle/123456789/4321>.

PATENT

Sl. No.	Title Details	Details of award of patent / Filed
1.	Intelligent monitoring and controlling of charging and discharging of Electric Vehicles batteries	Patent no. 202111006557(published) dated 26/02/2021
2.	Stragedy economic analysis of plug-in battery of electric vehicle	Patent No. 202211007133 published dated 10/02/2022

INTERNATIONAL & NATIONAL CONFERENCES

1. **Prashant**, A.S Siddiqui, Md. Sarwar, “**An Optimum GA based solution for Economic Load Dispatch for Clean Energy**, 3rd International Conference on Machine Learning, Advances in Computing, Renewable Energy and Communication(MARC-2021), Dec 10-11, 2021. [will be published as book chapter in springer book series LNEE scopus indexed]
2. **Prashant**, A.S Siddiqui, “**Congestion Management based on minimization of TCC and Optimal placement & sizing of DG**”, IEEE Bombay Section Signature Conference (IBSSC-2021), 18-20 November, 2021, DOI: 10.1109/IBSSC53889.2021.9673262.
3. **Prashant**, A. Saxena, et al ” **Design of Buck Converter with Modified P&O Algorithm Based fuzzy logic controller for solar charge controller for efficient MPPT**”, International Conference on Intelligent Computing and Security: A Paradigm Shift(IICS 2021), 17-18 December, 2021. [will be published as book chapter in springer book series LNEE scopus indexed]
4. **Prashant**, Amurt Prakash, et al “**An innovative approach for charging and discharging of battery using MPPT controlled solar PV system integrated with bidirectional DC-DC converter**”, 3rd International Conference on Machine Learning, Advances in Computing, Renewable Energy and Communication(MARC-2021), Dec 10-11, 2021. [will be published as book chapter in springer book series LNEE scopus indexed]
5. A. Singh, A. Saxena, **Prashant**, “**Novel Power Coefficient for extracting the maximum power in wind power based Doubly fed Induction generator (DFIG) using vector control**”, IOP

Conference Series: Materials Science and Engineering (MSE)(scopus) , ISSN:1757-899X,Vol-**594**(2019)012007 ,pp 1-11 doi:10.1088/1757-899X/594/1/012007.

6. **Prashant**, Nirmal Kumar Agarwal etal “**A Strategic Technique For Transient Stability Enhancement By Using Coordinated Control of SVC And Optimal Reclosure Of Circuit Breaker**”, IEEE 5th International Conference on Information Systems and Computer Networks(ISKON-2021),GLA University Mathura,22-23rd October,2021 DOI: 10.1109/ISCON52037.2021.9702403.
7. Prashant, Anwar Shahzad Siddiqui,Naresh Kumar, “**An Optimal Mechanism for Positioning of DG for Stability Enhancement of 33 IEEE Bus System Using Genetic Algorithm (GAs)** , IEEE 2nd International conference on Contemporary Engineering and Technology Evolution 2020(ICCETE-2020), June 13-14, 2020,Inderprastha Engineering College, Ghaziabad.
8. **Prashant**, Md. Areeb, Md. Saem, Ankit Singh, “**Modeling Strategy and Analysis of Solar PV Array Generated Photo-Voltaic Current**” ,International Conference on Intelligent Control and Computation for Smart Energy and Mechatronic Systems (ICCSEMS2020)” ,25-26 September,2020, JSSATE, Noida.
9. Prashant, Sanjiba Kumar Bisoyi, Nirmal Kr. Agarwal, “**An Overview of the Applications and Advancement of Industrial Automated System and it’s Controlling through PLC-SCADA**”, National Conference on “Smart Energy, VLSI and Embedded Systems” (NCSEVES-2021),24-25 September,2021, JSSATE, Noida.
10. Abhinav, **Prashant**, Palak Tusyan, A singh, ' **Study of various FACTS devices for steady and dynamic state stability of Power System'** , IEEE Conference INDIACOM 2018 on “Computing For Sustainable Global Development” , ISSN: 0973-7529, ISBN 978-93-80544-28-1 , Bharati Vidyapeeth’s Institute of Computer Applications and Management(BVICAM),New Delhi, 14-16th March,2018. (Scopus indexed).
11. Abhinav,**Prashant**, Sanjiba Bisoyi, Abul Kalam, “**Protection of 3 phase induction motor under single phase fault**”, International Conference on “ Advances in Business and Engineering for Sustainability(ABES-2018) “, ABES Engineering College,Ghaziabad (U.P), 27th-28th March 2018.
12. Abhinav Saxena,Prashant “**Analysis Three Phase Induction Motor in Different Speed Reference Frame Coordinates**”, IEEE International Conference on Power, Control , Signals and InstrumentationEngineering(ICPCSI-2017), ,Vol.1,pp549 552,September, 2017, DOI:10.1109/ICPCSI.2017.8391772.
13. Abhinav , **Prashant**, Saurabh Trivedi, “**Fault Injection Aanalysis of Wound Rotor Induction Motor and Doubly Fed Induction Motor (DFIG)**”, IEEE Conference INDIACOM 2017 on “Computing For Sustainable Global Development”, ISSN 0973-7529, ISBN 978-93-80544-24-3, Bharati Vidyapeeth’s Institute of Computer Applications and Management (BVICAM), New Delhi, 1st-3rd March, 2017.
14. **Prashant**, Anwar Shahzad Siddiqui, “**Application of FACTS Devices in Modern Power System Operations**” published in National Conference on Emerging Trends in Electrical and Electronics Engineering (ETEE)-2015, Jamia Millia Islamia, New Delhi, Vol.1 pp.352-361,February, 2015.
15. **Prashant**, A.S Siddiqui, Md. Sarwar, “**Loational Marginal Pricing Based Management of Congestion with Optimum Sizing of Distributed Generator using Modified ILSHADE Algorithm**”, IEEE International Conference on Electronic Systems and Intelligent Computing-ICESIC 2022, 22-23 April,2022 at Veltech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Chennai-62. (accepted).

List of NPTEL Certifications

1. NPTEL-AICTE FDP on “**Non-Conventional Enery Resources**” (12 weeks) (Jan-April,2020).
2. NPTEL-AICTE FDP on “**DC Microgrid and Control Systems**” (8 weeks) (Sep-November,2020).
3. NPTEL-AICTE FDP on “**Ethics in Engineering Practice**” (8 weeks) (Feb-April,2020).
4. NPTEL-AICTE FDP on “ **Power System Dynamics , Control and Monitoring**”(12 weeks) (Jan-April , 2019).

List of SKILL/ FACULTY DEVELOPMENT PROGRAMMES

1. GIAN(Global Initiative of Academic Networks) course- **Role of Smart Building Energy Management System in the Development of Smart City** sponsored by MHRD , Govt of India at **Jamia Millia Islamia, New Delhi** from 6/3/2018 to 10/3/2018.
2. One Week Modular Course on **basics of Cryptography and Information Security"-C-DAC, Noida** from 18/9/2017 to 22/9/2017.
3. One Week Online AICTE-QIP Sponsored Short Term Course on **"Issues and challenges of grid connected renewable energy sources (ICGCRE-22)"** from 21st-25th February, 2022 at Jamia Millia Islamia, New Delhi.
4. AICTE Training And Learning (ATAL) Academy, **" Online Elementary FDP on "Modern Innovations and Development in Renewable Energy Technology"** from 12/07/2021 to 16/07/2021 at University of Lucknow.
5. AICTE sponsored STTP on **"Power Electronic Applications for Smart Grid, Electric Vehicles and Renewable Energy"** from 26th November to 1st December 2020 organized by Department of Electrical Engineering, JSSATE, Noida.
6. TEQIP-III Two week International online FDP on **"Techno-Economical and Environmental Aspects of Electrical Energy Systems for Sustainable Development "** (September 7th to September 18th, 2020), G.B Pant Institute of Engineering and Technology, Uttarakhand.
7. Two week FDP on **'Entrepreneurship'** (2 Jan, 2019 to 15 Jan, 2019) **sponsored by Department of Science & Technology, Govt of India** at ABES Engineering College, Ghaziabad.
8. Two week Online Faculty Development Program on **"a2z of NBA Accreditation Process"** during August 24th -September 09th, 2021 organized by Department of Electronics & Communication Engineering under the aegis of Internal Quality Assurance Cell (IQAC), Inderprastha Engineering College, Ghaziabad.
9. TEQIP-III One week FDP on **"Sustainable, reliable solutions to power quality problems in smart power system network"**, at JSSATE, Noida from 08/10/2018 to 13/08/2018.
10. **One week FDP on "Green Chemistry and Clean Technology"** at JSSATE, Noida from 11/6/2018 to 16/06/2018.
11. One Week International Faculty Development Program on **"Digital Learning with Multidisciplinary Approaches (DLMA)"** , 12-17 June, 2020 at JSSATE, Noida.

Organizer or Coordinator of Seminars/conferences/symposia/ workshops/training programmes etc.

1. Member-Organising Committee of One Day Seminar on **"Application of Soft Computing Techniques on Distributed Energy Resources in a Smart Grid"** held at JSSATE, Noida on 24/03/2018.
2. Member –Organising Committee of National Conference **" Smart Energy Systems NCSES 2019 "** held at JSSATE, Noida on 14-15 June, 2019.
3. Member –Organising Committee of One week FDP on **"Sustainable, reliable solutions to power quality problems in smart power system network"**, at JSSATE, Noida from 08/10/2018 to 13/08/2018.
4. Member –Organising Committee of One week AICTE sponsored Short Term Training Programme(STTP) on **Power Electronic Applications for Smart Grid, Electric Vehicles and Renewable Energy"** from 26th November to 1st December 2020 organized by Department of Electrical Engineering, JSSATE, Noida.

Membership of Professional Bodies:

1. Life Membership in Institution of Engineers (INDIA)- AM183641-5

Other information about professional experience

1. Awarded Title of **Chartered Engineer** from Institution of Engineers (India)
2. Served as Reviewer in reputed International Journals and Conferences like Applied Soft Computing Technology, SCIE indexed Journal, Electric Power Components and Systems, SCIE indexed Journal, Computer and Electrical Engineering, SCIE indexed Journal, International

Journal of Computing and Digital System(Scopus) and 2021 International Conference on Innovation and Intelligence for Informatics, Computing, and Technologies (3ICT).

3. Served as member in various committees of the department like NBA, NAAC, Examination, Placement etc.

Project Guidance/Skill Development of Electrical Engineering Graduates on the topic:

1. An optimize solution to select portfolios of electricity generation methods with renewable energy.
2. Comparative study of MPPT control schemes for SPV systems and its grid synchronization.
3. Design and analysis of grid connected Solar Photovoltaic Systems.
4. Underground cable fault detection and its distance determination using AT89S52 micro-controller.
5. Design and Development of Solar-Wind Hybrid Power Generation with Inclusion of Solar Tracker.
6. Power Quality Improvement by using DSTATCOM.
7. Small signal modeling of Cuk, Sepic DC-DC converters and its stability analysis.
8. An innovative approach for charging and discharging of battery using MPPT controlled solar PV system integrated with bidirectional DC-DC converter.
9. Designing of Buck Converter with modified P & O algorithm based switching for solar charge controller for efficient MPPT.
10. Modeling & Simulation of Solar PV system and its synchronization with Home Grid.
11. Optimal placement of DG based on minimum losses for improvising the technological performance of power system network.

INTERNSHIP

Indian Farmers Fertilizer Cooperative Ltd. (IFFCO), Aonla Unit, Bareilly.

Hands of experience on Power System Network of IFFCO, Electrical Workshop Function, Overall Transformer Oil Testing, Electric Supply Sources, Description of Power Plant, Circuit Breakers, Protection and Control.

Academic Achievements

1. Qualified GATE, an All India Competitive Examination For Engineering Graduates.
2. Recipient of MHRD Scholarship during M.Tech (EPSM) at JMI, New Delhi for GATE qualified candidates during July 2013 to June 2015.
3. Research Papers published in International/National journals and conferences of repute.
4. 1st division throughout academic career.

Technical Skills

1. Proficiency in MS Office and Internet applications/technology.
2. Knowledge of software tools like :
 - C, C++
 - MATLAB, Simulink, PSPICE, PSCAD, PV Syst.
 - Artificial Intelligent Techniques likes Genetic Algorithm, Artificial Neural Network, Fuzzy Logic, PSO etc. and their applications in modern power system operations.

Extra Curriculars

1. Organisation Committe Member of various seminar, conference and faculty development programmes in the institute.
2. Member of various administrative bodies like NBA, NAAC and Examination Cell and placement committee and other responsibilities like Industrial Visit Coordinator, Class Coordinator , Library Coordinator etc. at the institute level.
3. Management of various technical & cultural events related to the students in the college and actively participated in all the extra-curricular activities at the institute level.

Personal Profile

Date of Birth : May 27,1989
Father's Name : Mr. Anil Kumar Gupta
Address : Flat No. 704, Tower-8, Exotica Dremville, Greater Noida(West),(U.P)-201301.

Languages Known : English, Hindi
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Date Of Issue: 31/12/2010, Date Of Expiry: 30/12/2020.

REFERENCES

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Optimal Cumulative Cost Strategy for the Thermal-Solar Integrated Radial Distribution System with Minimized Carbon Footprint for Sustainable Solution for Clean Energy

Anwar Shahzad Siddiqui & Prashant

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Optimal Cumulative Cost Strategy for the Thermal-Solar Integrated Radial Distribution System with Minimized Carbon Footprint for Sustainable Solution for Clean Energy

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ABSTRACT

The article presents optimal cost approach for the solar-thermal integrated radial distribution system. The gap between supply and demand can be bridged by integration with solar photovoltaic systems to existing networks. Such integration consequently increases size of power system network components and enhances cost of the system. The cumulative cost of system consists of thermal emission cost, thermal fuel cost, direct cost of solar generation while emission cost of solar is indirectly contributed in the form of raw material extraction, transportation, manufacturing of solar photovoltaic cell etc. The carbon emission releases its mark into atmosphere as a carbon footprint. In order to overcome such issue, an optimal complex non-linear multi-objective is framed separately for component size, thermal generating cost and solar generation direct cost while another multi-objective function represents the solar indirect cost and carbon footprint which is represented as loss of carbon emission which comprises three components: loss of cost of energy, loss of power supply probability and cost constraint. The multi-objectives function has been minimised with the proposed power exponential method and genetic algorithm. The reliability and effectiveness of the proposed methodology has been tested successfully on standard IEEE-30 bus system. It is observed that optimal thermal fuel cost, thermal emission cost, total thermal generating cost, solar direct and indirect cost and thereby total solar generating cost and finally cumulative cost of system, plus carbon footprint estimation are found to be lesser with proposed method in comparison with genetic algorithm and existing techniques.

ARTICLE HISTORY

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KEYWORDS

emission cost; thermal cost; fuel cost; solar; power exponential method; genetic algorithm; carbon footprint; loss of cost of energy; loss of power supply probability; cost constraint

1. Introduction

Rising oil costs, environmental issues, and rapid deterioration of existing fuel supplies have expanded the reach of renewable resources considerably. Most of the world's electricity sector is structured as an integrated infrastructure that depends heavily on traditional electricity generation. To suit the demands of the twenty-first century, this structure would need to be modified and improved. By considering the electrical network of power grid configuration which includes demand side management, economic load dispatch framework, and power system's flexible capabilities (Saadat 1999), which utilized to support large-scale renewable power incorporation and consumption. Economic Load dispatch (ELD) is an essential and continual step in power system strategic management (Morshed and Asgharpour 2014). ELD is a challenge that involves allocating power to each committed generation unit in order to reduce overall operating costs while meeting certain constraints. Power balance relationships, generator power caps, prohibited operational areas, ramp rate limitations, etc. are constraints among them (Liu, Xiao, Wu et al. 2021). In the related research literature, various optimization methods containing equality as well as non-equality constraints were being implemented for ELD (Vlachogiannis and Lee 2010). The biography-based valve point effect has been proposed for the estimation of economic

dispatch (Xiong et al. 2014). A stochastic optimization methodology for economic scheduling with the variation in wind speed is shown in Yang et al. 2016. Another way of varying the wind constraint with fuzzy logic is shown in Miranda and Sio Hang 2005. A meta-heuristic method also provides the economic solution to the renewable energy network (Ellahi and Abbas 2020). Intelligent approaches such as squirrel search algorithm; PSO; neural network; and genetic algorithm (GA) are used to solve complex constrained ELD (Lee, Sode-Yome, and Ho Park 1998). An optimal reduced fuel and emission cost has been assessed with squirrel-based algorithm (Sakthivel, Suman, and Sathya 2021). A tabu search algorithm also helps to reduce the economic dispatch issues (Mantawy, Soliman, and El-Hawary 2002). A genetic algorithm-based augmented Lagrangian function was used for providing the optimal cost of the system as discussed in Nepomuceno et al. (2015). A novel particle swarm optimization worked on solving issues of convex economic load dispatch problem (Selvakumar and Thanushkodi 2007). ELD becomes a multi-objective optimization challenge when both price and emissions are also to be minimized while implementing ELD and is known as combined emission economic dispatch (CEED) (Khan, Sidhu, and Gao 2016). There are two non-convex ELD complications given as ELD with piecewise quadratic cost function and also the ELD of restricted operational areas. The ripple alike non-convex

RESEARCH ARTICLE

WILEY

Optimal intelligent strategic LMP Solution and Effect of DG in Deregulated System for Congestion Management

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Summary

This article presents intelligent controlling on locational marginal pricing (LMP) of deregulated system for congestion management. Transmission line congestion is a critical concern, and its governance raises a technological obstacle when deregulating the electricity grid. Congestion throughout the unregulated energy market occurs where transmitting capacity is not adequate to reach all the demand transmission constraints across a line. The congestion management is decided by using the LMP difference between two buses. The existing methods have higher LMP cost due to which controlling of LMP is assessed by using a hybrid approach and genetic algorithm (GAs). The LMP difference obtained with GAs is lesser than hybrid approach which makes system economical. After the selection of uniform and high demanded congested zone, a distributed generator (DG) is used to fulfill the demand. The DG is represented by solar PV array and connected to bus through converters. The switching of the converter is assessed by a fuzzy logic controller (FLC) and vector control. The implementation of FLC improves the THD of real and reactive power generated by DG in a better way in comparison to vector control. The performance analysis is tested on standard IEEE 9-bus system, standard IEEE 14-bus system, and standard IEEE 57-bus system on Simulink.

KEYWORDS

DG, FLC, GAs, LMP

List of Symbols and Abbreviations: ρ_i , locational marginal pricing (LMP); MEC, marginal energy cost (C); $\lambda_{c,i}$, congestion cost (CC); $\lambda_{L,i}$, loss component (LC); ΔP , change in real power; ΔQ , change in reactive power; Δf , change in flow rate; S_i , complex power at i th bus; S_{ij} , complex power between i th and j th bus; S_D , complex power demand; Y_{ij} , admittance between i th and j th bus; V_i , voltage at i th bus; δ , load angle; θ , impedance angle; $E_{p,i}$, energy generation at i th bus; $E_{p,ij}$, energy dissipated between two buses; η , efficiency; k_{pf} , power factor; t_1 , proportionality constant; GA, genetic algorithm; μ , operating cost for loss component; $a(t)$ and $b(t)$, nonlinear controller power; K_p , proportionality constant; ΔP_{conv} , change in conventional source power; ΔP_{PV} , change in PV module power; ΔP_L , change in load power; Δf , change in frequency; H , inertia constant of the machine; S , rated power of the system; S_{PV} , rated power contribution of the solar PV array; H_{PV} , inertia constant of the solar PV array; H_{conv} , inertia constant of conventional thermal source; g , distortion factor; DG, distributed generator; FLC, fuzzy logic controller; NR, Newton-Raphson method; P_i , real power; Q_i , reactive power; NB, negative big; NM, negative medium; NS, negative small; ZS, zero; PB, positive big; PS, positive small; PM, positive medium; p.u, per unit; P&O, perturb and observe method; PV, photovoltaic; MPPT, maximum power point tracking; PD, proportional derivative; THD, total harmonic distortion; λ , operating cost for cost component; $\lambda_p, \lambda_q, \mu_p^-, \mu_p^+, \mu_q^-, \mu_q^+$, inequality constraint; $\mu_l^-, \mu_l^+, \mu_v^-, \mu_v^+$, sharing ratio; K_d , derivative constant; s , Laplace operator; ΔP_{solar} , change in solar power; $\Delta P_{thermal}$, change in thermal power.

ORIGINAL RESEARCH

Open Access



Optimal Location and Sizing of Conglomerate DG- FACTS using an Artificial Neural Network and Heuristic Probability Distribution Methodology for Modern Power System Operations

Anwar Shahzad Siddiqui¹ and Prashant^{2*}

Abstract

In existing power system networks, the positioning and sizing of multi-DG is critical at the optimum locations for effective energy management. Initially optimal power flow is assessed using the NR method (without DG) in which performance parameters such as real power loss, accuracy, selectivity and MSE are obtained, but in an undesirable manner. To meet load demand; multi-DGs are placed and their optimal locations are assessed by the proposed heuristic probability distribution methodology and an ANN because existing techniques provides poor performance parameters for selecting the location and sizing of DGs. The optimal positions of multi-DGs are estimated in terms of performance parameters including real power loss of transmission network, accuracy, selectivity and MSE, while the performance parameters obtained with the ANN are better than the heuristic pdf. Then, the sizing of multi-DGs is evaluated in relation to active and reactive power. It is found that that sizes of multi-DGs are smaller with ANN than with heuristic pdf. It is preferable to connect the buses having lowest real power losses with the smallest multi-DGs. The performance analysis is tested in the standard IEEE 9- bus and IEEE 57- bus systems on Simulink. To improve the distortion level in real and reactive power, multi-FACTS namely TCSC, TSC and STATCOM are used. The switching of TCSC and TSC is done by SPWM while STATCOM switching is controlled with ANFIS. The locations of multi-FACTS devices are chosen for buses having larger distortion and the sizing of multi-FACTS devices is also optimally decided. The application of multi-FACTS devices helps to improve power quality and fulfill load demand with minimal size in order to make the system economical.

Keywords: DG, Location, Sizing, FACTS, ANN, ANFIS

1 Introduction




Optimal deployment and sizing of different distributed generators (DGs) in power system networks have to derive the full possible benefits, given the context of natural, economic and technological aspects which remains

a challenging task for both infrastructure and consumers. DG penetration involves a major change for conventional electricity schemes [1]; it affects voltage stability [2] as well as energy losses [3, 4] while adjusting power flow in the extant power system infrastructure. The degree to which DGs minimize failure of power systems operation and boost voltage profile are dependent on their sizing and position [5]. Optimisation methods can be used in the deregulated power industry to make the best DG allocation [6]. In [7, 8]; the optimal positions of DG are

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Article

Optimal Location and Sizing of Distributed Generators in Power System Network with Power Quality Enhancement Using Fuzzy Logic Controlled D-STATCOM

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Abstract: This article presents the selection of location and sizing of multiple distributed generators (DGs) for boosting performance of the radial distribution system in the case of constant power load flow and constant impedance load flow. The consideration of placing and sizing of DGs is to meet the load demand. This article tries to overcome the limitations of existing techniques for determining the appropriate location and size of DGs. The selection of DG location is decided in terms of real power losses, accuracy, and sensitivity. The size of DG is measured in terms of real and reactive power. Both positioning and sizing of DG are analyzed with the genetic algorithm and the heuristic probability distribution method. The results are compared with other existing methods such as antlion optimization algorithm, coyote optimizer, modified sine-cosine algorithm, and particle swarm optimization. Further, the power quality improvement of the network is assessed by positioning D-STATCOM, and its location is decided on the basis of the nearby bus having poor voltage profile and high total harmonic distortion (THD). The switching and controlling of D-STATCOM are assessed with fuzzy logic controller (FLC) for improving the performance parameters such as voltage profile and THD at that particular bus. The proposed analytical approach for the system is tested on the IEEE 33 bus system. It is observed that the performance of the system with the genetic algorithm gives a better solution in comparison to heuristic PDF and other existing methods for determining the optimal location and size of DG. The introduction of D-STATCOM into the system with FLC shows better performance in terms of improved voltage profile and THD in comparison to existing techniques.

Keywords: distributed generator; D-STATCOM; fuzzy logic controller; genetic algorithm; power quality



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1. Introduction

The current activities of the advanced power system have become very complicated, which needs to necessarily satisfy the increasing energy needs in an efficient manner [1,2]. The civil, fiscal, and other substantial considerations warrant the site of generation centers being placed at places distant from load centers. The reorganization and deregulation of power companies have led to making system governance unpredictable. The factors which are to be considered while carrying out extension of the transmission system are the following: cutback stability margins, chances of tripping outages, and rising power cuts. The distributed generator (DG) installation would be of the utmost benefit where the installation of new transmission lines and setting up of new power-generating units are not feasible [3–5]. It is also reasonable to believe that the selection of the right DG technology, including the optimal location and scale of the DG, would help in decreasing the losses in such a system. The purpose of optimally placing DG in a power system network is for achieving correct operation of the network with system error minimization and voltage profile enhancement inclusive of improved stability, reliability, and load

An Advance Methodology for Hybrid Modeling and Selection of Grid Integrated Renewable Energy [Wind/Solar] Profile through Proteus

Prashant, Anwar Shahzad Siddiqui, Abhinav Saxena, Satyam, Vidushi, Shikha

Abstract: This paper shows the synchronization of grid integrated renewable energy and conventional sources feeding a load centres using proteus. The certain factor like variation in solar radiation, wind and load demand has been taken into consideration. The most challenging task during synchronization is selection of particular generating sources. In this Paper, Experimental hybrid modelling of grid integrated renewable energy projects (wind, solar) and conventional supply source has been performed. The experimental result verified on simulation platform proteus software through Arduinouno microcontroller. The output of system confirms the selectivity of particular energy source as per requirement of changing in the load demand and environmental conditions.

Index Terms: hybrid, modelling, proteus, modelling, solar, wind.

I. INTRODUCTION

In today's expeditiously and randomly developing technical era, eventual requirement for fruitful existence of human race is electricity. Several methodologies could be adopted in order to store, amplify or convert the electrical energy for the future use. To have an effective understanding of the electric energy and its sources, several theories are given and are required to be discussed for the sustainable use of the energy [1],[2],[3]. The energy sources are divided into three main categories where first is fossil fuels, second is renewable sources and third is nuclear sources. Coal, natural gas and petroleum are counted under fossil fuels. Hydroelectricity, solar and wind power are counted under resources of renewable energy. Apart from these fusion and Fission are considered as nuclear-powered sources of energy. Out of these, the most abundant and convenient are solar and wind energy [4],[5]. As the earth receives an inexhaustible and incredible supply of solar radiation and has an average wind velocity of about 20-25 ms⁻¹. So, we are using these two sources for the generation of power. The most powerful energy sources which are considered to serve the large areas and capacities are solar and wind [6],[7]. This paper includes Simulation and selection of supplies from sources done by

Arduino Uno in Proteus software. Proteus is one of the most reliable software for simulation. Whenever Solar and wind energies are insufficient for load demand conventional supply is used [8],[9],[10].

II. SOLAR PV ARRAY

Photovoltaic array is a linked collection of PV modules. The smallest element in this is photovoltaic cell which converts solar radiation into electricity [11],[12]. PV cell is basically a semi-conductor diode working on photoelectric effect. To generate maximum power 36 to 72 PV modules are formed by connecting cells in parallel or in series [13]. Figure 1 shows the photovoltaic system and its basic circuit configuration. The "four parameters model" reflects the circuit diagram of PV system, and contains series resistance, current source, parallel resistance, and a diode [14],[15]. The light generated in the solar cell is represented through current source, p-n junction's non-linear impedance is represented through diode, internal electrical losses are represented through series resistance and the leakage current to the ground is corresponded by shunt resistance.^[3] The light generated current source and diode are connected in anti-parallel way and reflects solar cell's ideal theoretical model. The falling of the solar radiation on the cell and the direct current generated are varied accordingly.[16],[17]

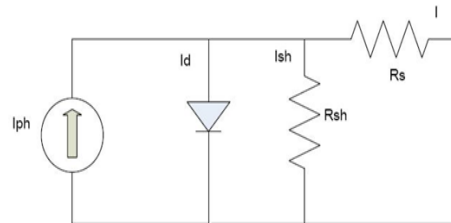


Fig.1. Photovoltaic cell (Basic circuit diagram)

According to the photovoltaic panel's circuit diagram as shown in figure 1, the characteristic equation is formed.

On applying KCL, the output current could be calculated as:

$$I = I_{ph} - I_d - I_{sc} \quad (1)$$

Due to the variance in temperature and irradiance, the light generated current also varies and the relation could be expressed through below mathematical equation [18].

$$I = I_{ph} - I_s \left[\exp \frac{(V + IR_s)q}{akT N_s} - 1 \right] - \frac{V + IR_s}{R_{sh}} \quad (2)$$

$$I_{ph} = I_r \frac{I_{sc}}{I_{ro}} \quad (3)$$

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