Journal of Critical Reviews

ISSN- 2394-5125 Vol 7, Issue 4, 2020

Review Article

ENHANCING THE PERFORMANCE OF DPFC ON DC SIDE USING REBOOST CONVERTER

D Narasimha Rao[1], P Srinivasa Varma[1]

Department of Electrical and Electronics Engineering, Koneru lakshmaiah Education Foundation, Vaddeswara, A.P, India.

Received: 05.12.2019 Revised: 07.01.2020 Accepted: 10.02.2020

Abstract
Fourteen-bus-framework with BOOST and RE-BOOST are mimicked and their outcomes are exhibited. The correlation represents that the output-voltage-ripple is diminished with MLI based DPFC framework. Fourteen bus-line-model with BOOST and RE-BOOST-converter are mimicked and the dynamic reaction shows that REBOOST converter produces better reaction when- make-out with-BOOST converter.

Keywords: Flexible Alternating Curren Transmission,-Boost&-Re-boost-Converter,-Unified Power Flow Controller, -Distributed Power Flow Controller, -Interline Power-Flow Controller, Separated-Interline-Power-Flow-Controller,-Distributed-FACTS(D s- FACTS),-Voltage-Source -Converter(VSC).

DOI: http://dx.doi.org/10.31838/jcr.07.04.108

INTRODUCTION

Move of energy from creating units to the utility clients, the term PQ criteria is generally significant. From customer point, the power quality issue is thought about current, voltage or recurrence deviation which causes the disappointment of intensity. For tackling the power quality issue another strategy dependent on the power electronic based hardware's called custom power gadgets one of the FACTS which is utilized in both transmission and dispersion control. Most of issues in transmission lines are, for example, voltage plunge, over voltage and intrusion.

This investigation of New FACTS Technology: UPFC, DPFC, IPFC and SIPFC was proposed by Kirithika[1]. Two methodologies are executed on UPFC to accomplished DPFC. DPFC comprise of parallel &series-convertors as in UPFC. The structure of parallel convertor is same as of the STATCOM, while the series-convertor for series pursues the idea of D-FACTS.

Any kind of failure in one converter will impact the entire framework because of the basic dc-link in UPFC. To accomplish the required unwavering quality for power frameworks, by-pass circuits and reinforcement transformer, and so forth are required, which additionally-expands the -expense of the-current-frameworks[2]. The parts of the UPFC handle the voltages and flows with high appraising so the absolute expense of the framework is high. Though in DPFC converters whether its shunt or series-converters, disappointment of any will causes least impact on hold. _On the off-chance that if-there- should-arise an occurrence of-shunt-disappointment, the various series-converters will go about as a distributed-series-converter disappointment, all the rest converters will repay it impact separately.

There are negative associations among the controllers of different FACTS segments in a framework. Going for the confinements and inadequacies of existing variable matching strategies and connection examination techniques, a blending strategy reasonable for enormous scale and numerous control factors is proposed dependent on the current NI record hypothesis, which is utilized to locate the ideal pair mix for making the associations among various controllers minimal[3]. The ideal pair blend is then broke down to acquire a gathering of info yield factors, which is generally identified with the seriousness of interactions,and a comparing control technique is set in like manner for the organized charging of numerous FACTS segments.

"-Equal model for organizing conveyed energy stream controller series-parallel converter energy trade" was introduced by Menglu [4]. Current power framework has entered another time of clever advancement. As a significant piece of keen lattice, the FACTS can improve the transmission limit of the matrix and increment the controllability and solidness of the network. Consequently, it has expansive advancement prospects.

Novel edge affectability based strategy for transient steadiness obliged ideal power stream was proposed by Xia. Transient steadiness obliged ideal power stream was as yet a troublesome yet significant issue in power framework arranging and activity. In this, the difficult TSCOPF issue is isolated into ideal power stream &steadiness investigation forms, and fathomed iteratively by the interior-point strategy[5].

The thorough quantitative record, security edge, can precisely mirror the impact of any power framework's parameter or structure changes on the steadiness. Along these lines, the strength of various frameworks can be carefully looked at [6]. By joining the one machine vast-bus proportional with various essential techniques, the equal parameters are always changed in the transient solidness investigation. Along these lines EEAC created from static EEAC to dynamic EEAC and incorporated EEAC.

In this request side, with the improvement of double correspondence, estimation &demand reaction innovation, the controllability of the mechanical and private burden is hugely upgraded [7-8]. When the framework is in a crisis task express, the system topology modification strategy, for example, load move is likewise a powerful methods for hazard control, particularly the network dynamic division innovation can rapidly and precisely search and alter explicit crisis plans

So as to adapt to the referenced issue of PV incorporated power framework chance appraisal and control, the current investigations primarily center around the accompanying viewpoints: 1) a few researchers make a solid examination of network operational hazard sources and segregate hazard variables as per the key components in the PV power plant and power lattice [9-11]. 2) some focus on the particular issues of power-network examination covering dependability investigation, static security investigation and transient steadiness examination and set forward inventive hazard pointers to reflect and measure the segment level or framework level static and transient hazard [12].

DPFC PRINCIPAL & MODELING

Structure of DPFC is shaped by the mix of a few individual converters as appeared in figu1 Series-converters are those which are associated in series to the transmission line framework. The motivation behind this series-converter is to infuse controllable voltage in the transmission line framework on the crucial recurrence which will prompting the controlling of power-stream. Shunt-converter is set between the transmission line, ground. The fundamental capacity of the shunt-converter is providing the genuine power that is required to series-converter for remuneration of the responsive power in lattice.

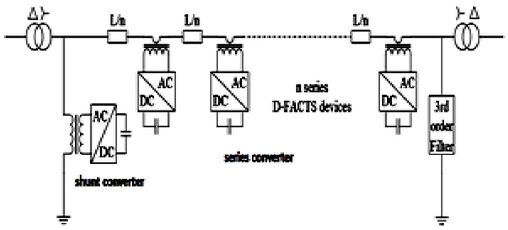
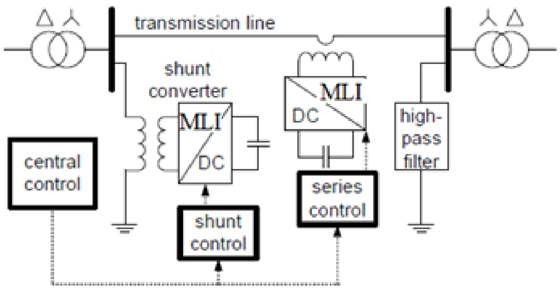


Figure 1. DPFC-structure

The genuine power is substituted by the harmonics in the lattice because of the nonattendance of DC-ink-capacitor connections shunt, series-converters. Significant source is the genuine power, is acquired by increasing the current and voltage which are the normal qualities. Be that as it may, these normal voltages and flows are containing the key harmonics.

CONTROL METHODOLOGY FOR MDPFC



Figu2. MDPFC-blockdiagram

Multilevel-DPFC is associated in a transmission line framework for power quality improvement. It comprises of a series-converter &a shunt converter. Both the converters are associated with MLI alongside DC Link capacitors. -A-Central-control System is utilized for controlling puspose. High pass channel is related at terminal end of transmission line framework. The MLI utilized in MDPFC are a 5switch7level MLI.

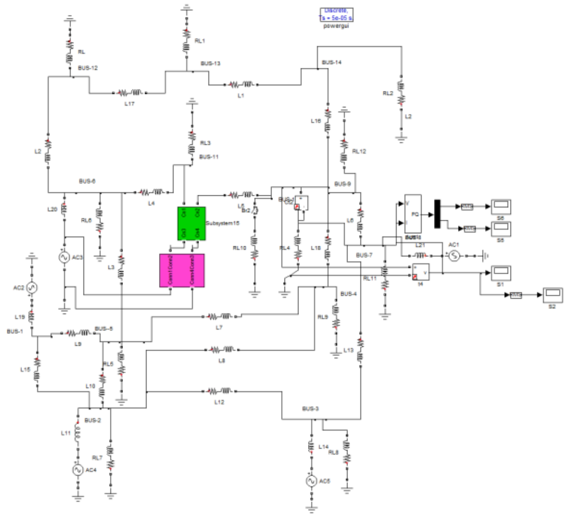
RESEARCH-GAP

The exceeding-writing does not pact with BOOST and REBOOST converter with DPFC. This investigation recommends with BOOST and REBOOST converter for DPFC-system. The exceeding-writing do not report the evaluation of BOOST and REBOOST converter for DPFC in 14bus line-model.

SYSTEM DESCRIPTION

Circuit-diagram of 14-bus-line model with DPFC is delineated in Fig 5. Voltage at bus-10 with DPFC is delineated in Fig 6. The value of voltage at bus 10 is $0.75*10^4$V. RMS voltage at bus-10 with DPFC is appeared in Fig 7 and its value is 5800V. Circuit diagram of boost with multilevel inverter is delineated in Fig 8. "-Output-voltage of boost-converter withDPFC" is delineated in Fig 9. -The value of output-voltage of boost-converter is 2000V. Voltage ripple of boost converter with DPFC is appeared in Fig10 &its value is 2050V. -Voltage across-multilevel inverter is delineated in Fig11 &its peak-value is 2400V. -Current through-multilevel inverter is delineated in Fig12 &its value is 16Amp.

RESULTS AND DISCUSSION



Figu5 Circuit diagram of 14-bus line model with DPFC

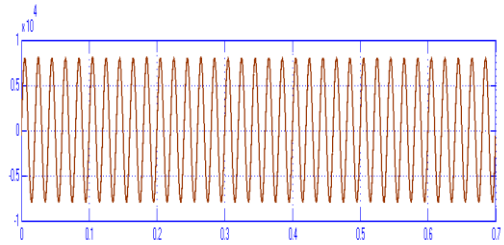


Figure 6 Voltage at bus-10 with DPFC

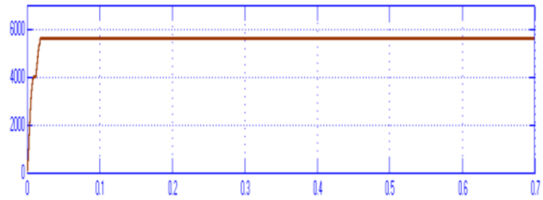


Figure 7 RMS voltage at bus-10 with DPFC

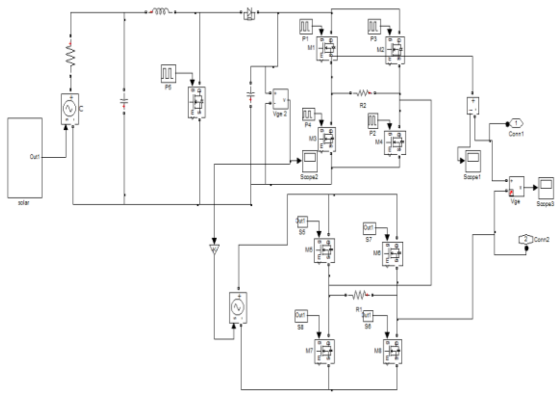


Figure 8 Circuit diagram of boost with multilevel inverter

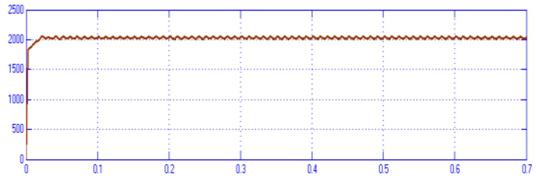


Figure 9 Output voltage of boost converter with DPFC

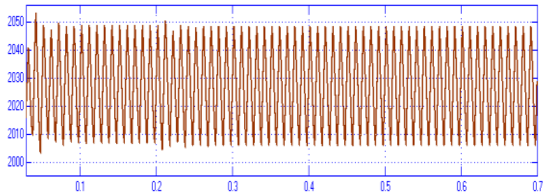


Figure 10 Voltage ripple of boost converter with DPFC

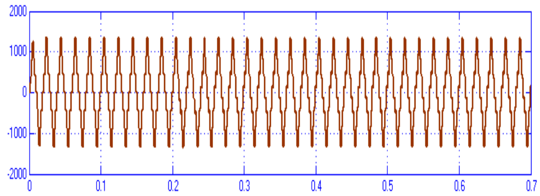


Figure 11 Voltage across multilevel inverter

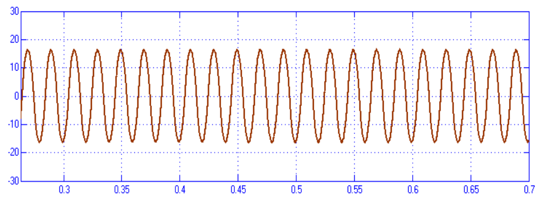


Figure 12 Current through multilevel inverter

The DPFC model is delineated in Fig13 and Real power at bus-10 with DPFC is delineated in Fig14 &its value is $6*10^5$Watts. Reactive power at bus-10 with DPFC is delineated in Fig 15 & its value is $3.6*10^4$ VAR.

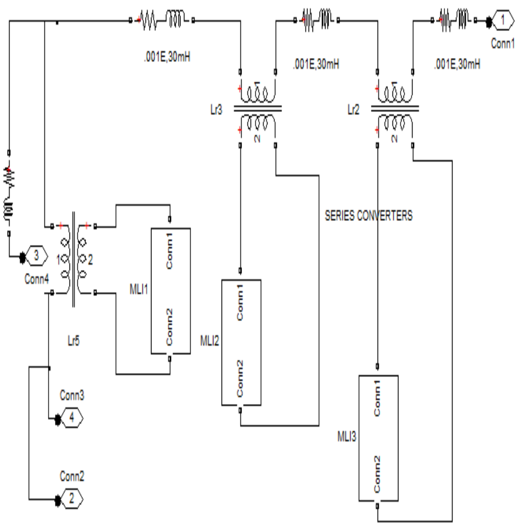


Figure 13 DPFC model

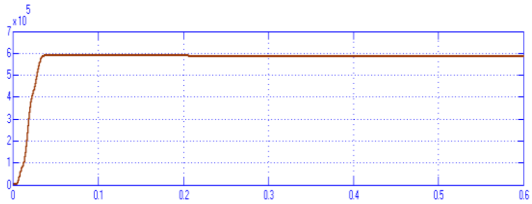


Figure 14 Real power at bus-10 with DPFC

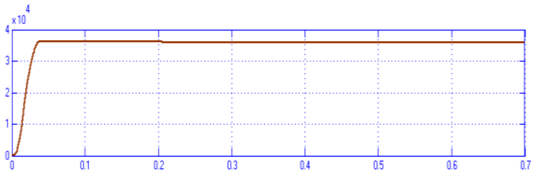


Figure 15 Reactive power at bus-10 with DPFC

Circuit diagram of 14-bus line model with DPFC is delineated in Fig 16. Voltage at bus-10 with DPFC is delineated in Fig 17. The value of voltage at bus 10 is $0.75*10^4$V. RMS voltage at bus-10 with DPFC is appeared in Fig 18 and its value is 6100V. Circuit diagram of Re boost with multilevel inverter is delineated in Fig 19. Output voltage of Re-boost converter with DPFC is delineated in Fig 20. The value of output voltage of boost converter is 2500V. Voltage ripple of Re boost converter with DPFC is appeared in Fig 21 and its value is 2510V. Voltage across multilevel inverter is delineated in Fig 22 and its peak value is 2200V. Current through multilevel inverter is delineated in Fig 23 and its value is 23Amp.

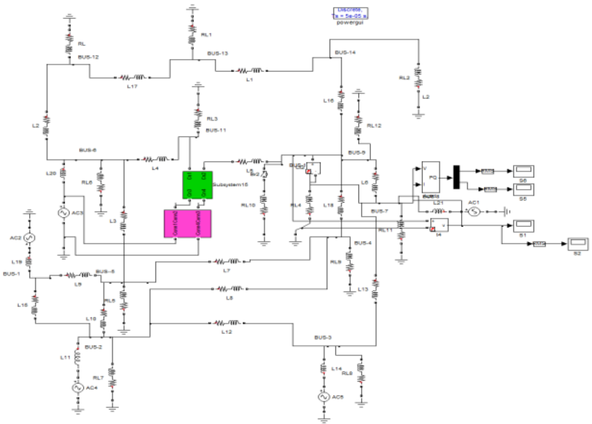


Figure 16 Circuit diagram of 14-bus line model with DPFC

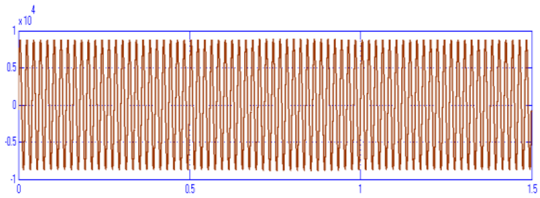


Figure 17 Voltage at bus-10 with multilevel inverter

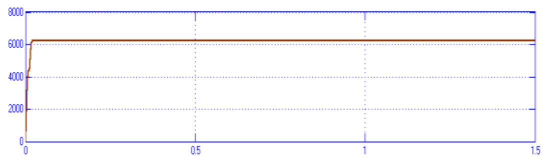


Figure 18 RMS voltage at bus-10 with multilevel inverter

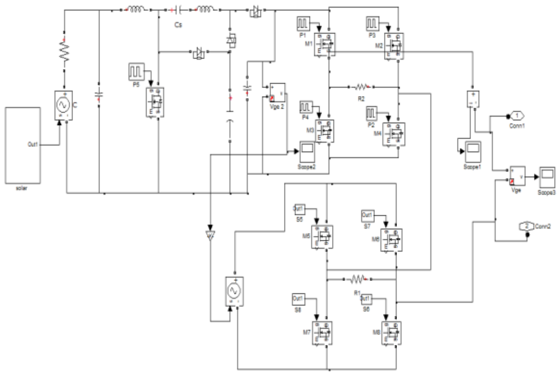


Figure 19 Circuit diagram of Re boost with multilevel inverter

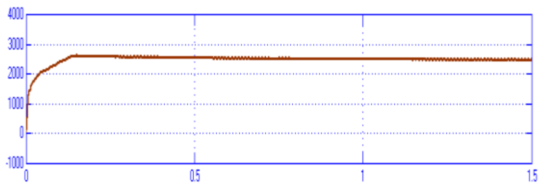


Figure 20 Output voltage of Re boost converter with multilevel inverter

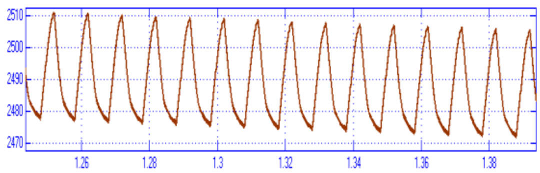


Figure 21 Voltage ripple of Re boost converter with multilevel inverter

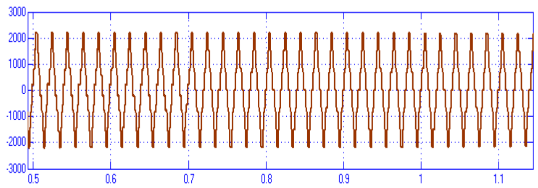


Figure 22 Voltage across multilevel inverter

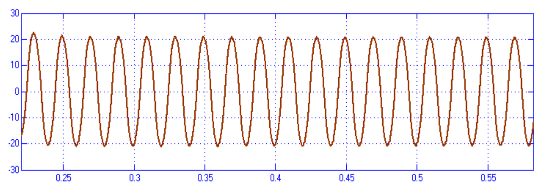
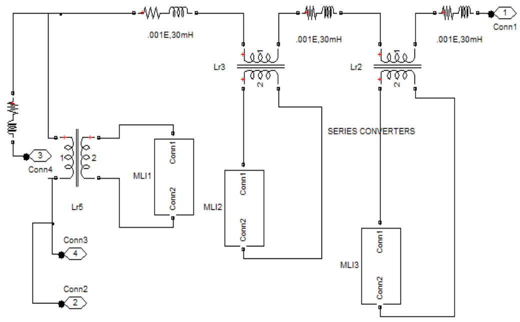
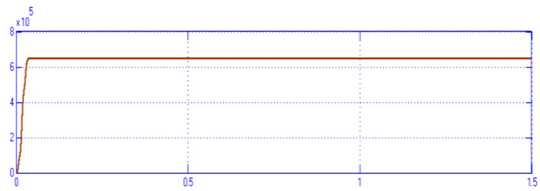


Figure 23 Current through multilevel inverter

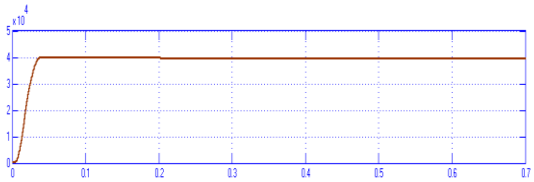
The DPFC model is delineated in Fig24 and Real power at bus-10 with DPFC is delineated in Fig25 &its value is $6.5*10^5$ Watts. Reactive power at bus-10 with DPFC is delineated in Fig15 &its value is $4*10^4$ VAR.



Figu24 'DPFCmodel'



Figu25 –Real-power at bus-10 with DPFC



Figu26-Reactive-power at bus-10 with DPFC

"-Comparison of output-Voltage, Voltage-ripple, Real-power & Reactive-Power in14-bus Re boost with multilevel inverter" is given in Table-1. By using RE-BOOST, real-power is increased from 0.5872MW to 0.6220MW; reactive power is enhanced from0.0363MVAR to 0.0382MVAR; output-voltage is enhanced from 2050V to 2480V; output-voltage-ripple is reduced from 40V to 28V.

Table -1
Comparison of Output Voltage, Voltage ripple, Real power & Reactive Power

14-bus	R (MW)	Q(MVAR)	Voltage(Vb)	V_{or}
BOOST	0.5872	0.0363	2050	40
RE BOOST	0.6220	0.0382	2480	28

CONCLUSION

Fourteen bus-line-models with BOOST and RE-BOOST-converter are simulated using Mablab-Simulink. By using RE-BOOST, real-power is increased from 0.5872MW to 0.6220MW; reactive power is enhanced from0.0363MVAR to 0.0382MVAR; output-voltage is enhanced from 2050V to 2480V; output-voltage-ripple is reduced from 40V to 28V.The outcome represents that the 'output-voltage-ripple' is diminished using RE-BOOST-converter. Hence, REBOOST converter is superior to -BOOST converter. The benefits of D-P-F-C is that the bus-voltage-profile is improved and the drawback of DP-FC is that it needs multiple-series- converters

REFERENCES

1. BulbulMewara, AnnapurnaBhargava, KritikaJain, " Conceptual comparative study of new FACTStechnology: unified power flow controller, distributed power flow controller, interline power flow controller and separated interline –power flow controller", *IJERT*, vol7, no 05, May2018, ISSN2278 0181.
2. NikitaGupta, VahadoodHasan, " Comparison of performance of distributed power flow controller (DPFC)& unified power flow controller(UPFC)", international jour.., of advanceengineering& research development vol 2,iss 4, Apr 2015.
3. JiangChenyang, LiuQing, LiangXiao, " Control variable pairing& coordinated commission in for multipleFACTS components", Electricpower automation equipment, vol37, no 4, pp179 184, 2017.
4. TangAihong, GaoMenglu, HuangYong et.al., " Equivalent model for coordinating –distributed energy flow controller series parallel converter energy –exchange [J]", Automation of electric power systems, vol42, no7, pp30 36, 2018.
5. ShiweiXia, KaWingChan, ZhizhongGuo, " A novel margin sensitivity based –method for transient stability constrained optimal power flow", Electric Power SystemsResearch, vol108, 2014.
6. ZhaoJinquan, QianLi, ChenGang, " A transient stability constrained optimal power flow model and method based on EEAC& trajectory sensitivity", Power system protection& control, vol43, pp9 13, May2015.
7. K.I.Sgouras, D.I.Dimitrelos, A.G.Bakirtzis, D.P.Labridis, " Quantitative risk management by demand response in distribution networks", Renewable& Sustainable Energy Reviews, vol82, pp502 514, 2018.
8. D.Moser, M.D.Buono, U.Jahn, M.Herz, M.Richter, " Identification of technical risks in the photovoltaic value chain& quantification of the economic impact", Progress in Photovoltaics Research& Applications, vol25, no7, 2017.
9. Sowmya, S., Sai Sri Vasthava, V.K., T Vijay Muni, —Active filter control strategies for renewable power generation systems using ANN controller||, International Journal of Innovative Technology and Exploring Engineering 8(5), pp. 690-696
10. Y.Shiwen, H.Hui, W.Chengzhi, G.Hao, F.Hao, " Review on risk –assessment of power system", ProcediaComput. Sci., vol109, pp1200 1205, 2017
11. D.Moser, M.D.Buono, U.Jahn, M.Herz, M.Richter, " Identification of technical risks in the photovoltaic value chain& quantification of the economic impact", Progress in PhotovoltaicsResearch& Applications, vol 25, no7, 2017.
12. Y.Shiwen, H.Hui, W.Chengzhi, G.Hao, F.Hao, " Review on risk assessment of power system", Procedia Comput. Sci., vol109, pp1200 1205, 2017
13. E.Ciapessoni, D.Cirio, S.Massucco, A.Morini, A.Pitto, F.Silvestro, " Risk based dynamic security assessment for power system operation& operational planning", Energies, vol10, no4, pp475, 2017.
14. T Vijay Muni, S V N L Lalitha, "Power Management Strategy in Solar PV System with Battery Protection Scheme in DC Microgrid", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-6, April 2019, pp:960-964.
15. T Vijay Muni, S V N L Lalitha, "Fast Acting MPPT Controller for Solar PV with Energy Management for DC Microgrid", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249-8958, Volume-8 Issue-5, June 2019, 1539-1544.
16. T Vijay Muni, P Srinivasa Varma, S Kiran Priya, J Bhavya, S Rajasekhar," Energy Management in a DC Microgrid with Energy Storage System", Jour of Adv Research in Dynamical & Control Systems, Vol. 12, Issue-02, 2020, 130-136