# A MULTILEVEL INVERTER TOPOLOGY WITH AN IMPROVED RELIABILITY AND A REDUCED NUMBER OF COMPONENTS

A Major project report
Submitted in partial fulfilment of
The requirements for the award of the degree of
**BACHELOR OF TECHNOLOGY**
in
**ELECTRICAL & ELECTRONICS ENGINEERING**

By


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# ABSTRACT

The reliabilities of the renewable energy source systems are affected by their inverter structures. So, an inverter topology with higher reliability reduces the maintenance cost of the system. In this article, a multilevel inverter structure is proposed with improved reliability and reduced component count. The proposed structure produces 7 and 11 voltage levels in symmetrical and asymmetrical configurations, respectively. This inverter topology utilizes six unidirectional switches and one bidirectional switch. The proposed inverter structure can be extended to generate any number of voltage levels with the inherent property of producing both positive and negative voltage levels. Various comparisons including the total number of switches, the total number of switch drivers, and the total blocking voltage are done to show the effectiveness of the proposed structure in the reduction of the component counts. In addition, the reliability of the proposed structure is analyzed and comparisons with other counterpart structures are studied. The comparison results show the reliability improvement of the proposed inverter structure. Finally, the simulation results, extracted by MATLAB/Simulink, and the experimental results, obtained from a laboratory prototype, are provided to prove the feasibility of the proposed multilevel inverter (PMI) structure.

# CHAPTER 8

# CONCLUSION

This article presented an improvement structure for multilevel converters in multiple dc sources applications. The structure of the proposed inverter produces up to 11 voltage levels with a reduced number of components. Furthermore, the PMI structure works under both symmetrical and asymmetrical conditions. The PMI structure can be extended in such a way to produce any number of desired voltage levels. Therefore, the PMI structure is a good choice for both renewable energy sources and high-voltage applications. The improvements have been shown by studying various comparison criteria of the PMI structure. The reliability as an important criterion in practical aspects has been considered in this article. In this regard, the related parameters for evaluation of reliability in multilevel structures are presented. Various comparisons are done between the PMI structure and different multilevel inverters in terms of the reliability, the number of switches, the number of gates drivers, total blocking voltage of switches, and efficiency. It is concluded the proposed inverter structure has a lower number of switches and better reliability compared with other counterpart inverters structures. Several simulations and experimental results are also presented to show the effectiveness of the PMI structure.

# COMMON DC BUS CHARGING SYSTEM FOR EVs WITH SOLAR, WIND, BATTERY, FUEL CELL SOURCES

A Major project Stage-I report
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# ABSTRACT

A promising solution to meet the growing charging demand of electric vehicles (EVs), is to incorporate renewable energy resources-based charging stations. Thus, a cascaded IIR filter is utilized here for the EV charging system based on PV array, fuel cell stack and wind turbine sources. The satisfactory operation during the grid availability/unavailability is attained through the current and voltage-based control mechanisms, along with the seamless transition capability via switching (STS-1/0) of the static transfer switches. Therefore, for adequate operation during modes associated with grid existence and non-existence, a cascaded IIR filter is utilized. Moreover, with respect to various weak grid conditions, adequate system performance is observed.

So, in this project stage -1 we have done up to literature survey and have studied about the matlab software. In the stage-2 of final documentation we are going to do simulation software and respected results.

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# MODELING AND SIMULATION OF PMSG BASED WIND SOLAR ENERGY BASED HYBRID ENERGY CONVERSION SYSTEM

A Major project Stage-I report

Submitted in partial fulfilment of

The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

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# ABSTRACT

Energy continuity is one of the important factors in the energy generation, transmission and consumption cycle. The continuous increase in energy demand causes diversity in energy resources. Alternative energy is getting more regarded because of aspects such as the fact that fossil resources are depleted and not sustainable. The hybrid energy conversion systems (HECS) are designed using two or more energy sources. The aim of this study is on the hybrid energy conversion system. A photovoltaic solar energy system and a permanent magnet synchronous generator (PMSG) based wind energy conversion system (WECS) are utilized in this hybrid energy conversion system. These energy systems enable us to feed a single-phase load independent of the grid by using a seven-level the Packed U Cell (PUC7) multilevel inverter. In this study, the proposed of HECS is designed and simulated using Matlab/Simulink. The simulation results demonstrate that under changing wind speed and irradiation circumstances, the hybrid energy conversion system can produce the appropriate output voltage and output power for the load.

So for in this project stage -1 we have done up to literature survey and about the Matlab software. In the Stage -2 of final documentation we going to do simulation software and respected results.

# SRF THEORY-BASED PI CONTROLLER APPLIED TO MICRO GRID INTERFACED WITH HYBRID SOURCES FOR POWER QUALITY IMPROVEMENT

A Major project Stage-I report

Submitted in partial fulfilment of

The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

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This is to certify that the major project Stage-I report entitled **SRF THEORY-BASED PI CONTROLLER APPLIED TO MICRO GRID INTERFACED WITH HYBRID SOURCES FOR POWER QUALITY IMPROVEMENT** submitted by the following students in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in EEE, and is a bonafide record of the work performed by

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# ABSTRACT

The importance of the Micro grid is increasing day to day because of reducing transmission cost, in comparison to the grid, microgrids have more renewable energy sources and it is easier to spot faults. If the main grid goes down, the microgrid can keep consumers comfortable by supplying power to homes and businesses for a while. The microgrid is best suitable in hilly areas and remote locations. Microgrid delivers important loads with a high-quality, consistent energy supply.

This project presents a Power quality improvement in Micro Grid used SRF theory. The microgrid is the interconnection of hybrid sources and load. The hybrid sources are PV cell, Fuel Cell, and Super Capacitor. By integrating these small sources, microgrids are implemented in generating the electrical power at load demand. The voltage and reactive power support to the external grid are examined using STATCOM deployed at various locations throughout the microgrid. The simulation results were verified in MATLAB/ SIMULINK software.

*So, in this project stage -1 we have done up to literature survey and have studied about the matlab software. In the stage-2 of final documentation we are going to do simulation software and respected results.*

# POWER QUALITY IMPROVEMENT USING ZSI-DVR

A Major project Stage-I report
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**BACHELOR OF TECHNOLOGY**

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# ABSTRACT

Our power system's main concerns are power quality issues. Voltage sags, swells, flicker, voltage notches, harmonic distortions, transients, and momentary interruptions are examples of such phenomena. These issues are mainly affecting to the industrial customers. Custom power system devices are the most suitable solution to mitigate such issues, which includes D-STATCOM, DVR, UPQC etc. Among them DVR is a better choice due to its better, efficient, reliable operation. Main part of a DVR is the Voltage Source Inverter (VSI) which is supplied by means of a battery or from a DC link capacitor. Basically, VSI are buck in action, obtainable output voltage cannot exceed the DC source voltage. For a PV supplied system there is a need of separate DC-DC boost converter in the input side of the VSI. DC-DC boost converter require more switches. This makes the overall system costly and also switching losses and total volume of the system become high. Also, whenever the two switches of the same leg is ON it leads to the shoot through (ST) and damages the inverter and reduce its reliability. Impedance source inverter (ZSI) is beneficial to inversion application that demands a high voltage gain from a very low voltage DC source such as Photo Voltaic generation. Voltage boosting, inversion and maximum power point tracking are all accomplished in a single stage with this inverter topology. It has minimized number of switching devices and it utilizes the shoot through state for the boost function. So, this paper mainly aims to improve the performance of DVR with the replacement of VSI by a ZSI and UVT-PWM (Unit Vector Template-Pulse Width Modulation) based control algorithm is used as the DVR controller. This paper analyses the voltage compensation performance under voltage sag and voltage swell conditions, also harmonic mitigation performance of the ZSI-DVR is analysed. This paper also aims to compare the performance of ZSI-DVR with performance of traditional VSI-DVR.

*So, in this project stage -1 we have done up to literature survey and have studied about the Matlab software. In the Stage -2 of final documentation we are going to do simulation software and respected results.*

# BIFUNCTIONAL GRID ASSISTED SOLAR PV FED SYSTEM FOR WATER PUMPING & DOMESTIC LOAD

A Major project report
Submitted in partial fulfilment of
The requirements for the award of the degree of
**BACHELOR OF TECHNOLOGY**
in
**ELECTRICAL & ELECTRONICS ENGINEERING**

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# ABSTRACT

This work deals with the development of a bifunctional grid assisted solar photovoltaic (PV) array for water pumping system (WPS) and domestic load. An undisturbed water delivery and hence the reliability is ensured by supplying a continuous grid support to solar PV generation. A synchronous reluctance motor is used to drive the water pump. Moreover, to make the system cost-effective, position sensor less based vector control algorithm is implemented. The system also consists of single-phase H-bridge inverter to supply PV array and grid power to domestic or local loads. A power factor corrected (PFC) boost converter is used to enable the unidirectional power flow from the grid to the DC link. The presented system and control ensure a consumer to have a continuous water delivery regardless of the atmospheric condition. The relevant power quality standards in terms of unity power factor (UPF) and total harmonic distortion (THD) necessary to be satisfied are met by the developed control. MATLAB/Simulink software environment is used for the simulation and the system performance is studied at different climatic conditions.

# CONCLUSION

A bifunctional grid assisted solar PV fed system for water pumping and domestic load with synchronous reluctance motor have been presented and demonstrated its behaviour using MATLAB/SIMULINK environment. The power transfer from grid to DC bus is controlled by using power factor corrected PFC boost converter. The singlephase grid acts as backup source. The system also consists of single-phase H-bridge voltage source converter to meet the local load demand. The power quality standard has been met as per IEEE-519 standard. The implemented system provides an uninterrupted water pumping irrespective of different atmospheric conditions. This system is observed to be effective and reliable water pumping system.

# ASSESSMENT OF 3-PHASE PHOTOVOLTIAC INTEGRATED UPQC FOR LOAD UNBALENCING CONDITION

A Major project (Stage-II) report
Submitted in partial fulfilment of
The requirements for the award of the degree of
**BACHELOR OF TECHNOLOGY**
in
**ELECTRICAL & ELECTRONICS ENGINEERING**

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# ABSTRACT

Power Quality (PQ) problems have turn out to be an imperative area under discussion and examination for the consumers, manufacturers are well awakened to understand the impacts of the problems. The custom power appliances are employed to diminish several of the PQ hitches depending upon the obligations. The proposed research study designs a UPQC system with the integration of solar array to provide the two-fold assistances in the face of clean energy generations along with the improvement of PQ of the electricity grid in the case of distributed generation, protects sensitive loads from source side as well as grid side consequences or disturbances with the help of custom power device including back to back connected shunt and series converter. The system is tested and analysed for load unbalancing condition, which may occur due to the sudden switching of heavy load. The activity of the system has been evaluated in MATLAB under load unbalance situations.

# CHAPTER 10

# CONCLUSION

PV-UPQC has been designed and its performance tested under various variations in power quality. The DVR is used for injecting the required voltage, which requires the lowest injection voltage in the grid voltage. SPV-UPQC has been tested and tested for the dynamic performance under load switching, resulting in load imbalance. The scheme has been seen to be constant in many disturbances. The SPV-UPQC system offers reactive power compensation together with active power from the solar PV array. The approach is mostly sensitive to changes and disproportion in Voltages at the PCC. The performance of d-q control has been carefully recovered in unbalanced load conditions by the use of an active average filters. PV-UPQC is superior for current power generation with an improvement in power quality. Modern distribution system such as smart grid where various many renewable energy sources can be used for power generation for such areas, the system can be implemented for power quality enhancement this can be a real time application of the system.

# DESIGN OF ULTRA-FAST ELECTRIC VEHICLE BATTERY CHARGER

A major project report submitted in partial fulfillment of the requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

**in**

**ELECTRICAL & ELECTRONICS ENGINEERING**

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This is to certify that the major report entitled **"Design of Ultra-Fast Electric Vehicle Battery Charger"** submitted by the following students, in partial fulfillment of the requirements for the award of Degree of Bachelor of Technology in Electrical & Electronics Engineering, and is a bonafide record of the work performed by the following students.

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# ABSTRACT

The demand for finding solutions to charge EVs as quickly as filling a fuel tank of an Internal Combustion Engine (ICE) vehicle increases. In this paper, the performance of a 2kW Cuk converter operating in Continuous Conduction Mode (CCM) and Discontinuous Inductor Conduction Mode (DICM) are assessed for Ultra-Fast Charging (UFC) of low voltage EV batteries such as the one used in golf carts. Besides, state-space modeling for the Cuk converter operating in DICM is carried out to design the output current controller. The designs were simulated and verified using MATLAB/Simulink, and the results show that the size and the complexity of the controller can be reduced when the Cuk converter operates in DICM, meeting the requirements of international standards.

# CHAPTER 8

# CONCLUSION

To conclude, a Cuk converter operating in DICM was modeled and analyzed to be used as an Ultra-Fast Charger for low voltage batteries such as the one used in golf carts. The state-space modeling of the Cuk converter in DICM shows a satisfactory agreement with the simulated circuit. Besides, the performance of the two Cuk converters operating in CCM and DICM were compared, and it was noted that the DICM operation is more suitable for the design of Ultra-fast Chargers because it could satisfy the international input power quality standards while keeping the size of the charger small and by using only a simple controller.

# SMOOTH TRANSITION OF A GRID CONNECTED PV SYSTEM TO STANDALONE OPERATION

A Major Project (Stage-I) report

submitted in partial fulfillment of the requirement

for the award of the degree of

**BACHELOR OF TECHNOLOGY**

in

**ELECTRICAL & ELECTRONICS ENGINEERING**

by


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*Under the Guidance of*

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# VAAGESWARI COLLEGE OF ENGINEERING

RAMAKRISHNA COLONY KARIMNAGAR – 505527

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## CERTIFICATE

This is to certify that the major project Stage-I report entitled "**SMOOTH TRANSITION OF A GRID CONNECTED PV SYSTEM TO STANDALONE OPERATION**" submitted by the following students in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in EEE, and is a bonafide record of the work performed by

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# ABSTRACT

This work introduces a control approach for a single stage solar photovoltaic (PV) generation system interfaced to the utility. In a single stage system, the voltage source converter (VSC) is used for MPPT (Maximum Power Point Tracking) operation of the PV array. It also maintains the DC-link voltage and converts the DC power produced by the PV array to the AC power to be supplied to the loads connected at PCC. The PSCs (Positive Sequence Components) of the unbalanced grid voltages are estimated for the evaluation of the unit templates. Moreover, it also provides the harmonics compensation of the load currents along with (UPF) unity power factor operation using multi-variable filter-based control algorithm. Thus, the distortion levels in the grid currents are decreased below 5%. During the grid failure, the system operates in standalone mode. A synchronization control is used for the smooth connection of the system to the grid during its availability and disconnection from the grid when it is unavailable. Experiments are done on a laboratory prototype at various dynamics and steady state conditions.

# A SOLAR PV SYSTEM WITH RESILIENT OPERATION AT WEAK GRID CONDITIONS WITH FLEXIBLE ADJUSTMENT OF DC LINK VOLTAGE FOR IMPROVED POWER QUALITY

A Major project (Stage-II) report

Submitted in partial fulfilment of

The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

in

**ELECTRICAL & ELECTRONICS ENGINEERING**

By


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# ABSTRACT

A solar photovoltaic array (PVA) generation unit, connected to a weak distribution utility grid, is presented in this work. The PVA power is maximized by an incremental conductance (InC) strategy-controlled boost converter. The weak grid is vulnerable to distortions, unbalance, voltage sag, and voltage swell. The implemented control structure utilizes a grid voltage filtering (GVF) stage, which keeps these grid voltage defects from impacting the regulated grid currents. The GVF also neutralizes any DC offset in the voltage signal. The DC link voltage is flexibly controlled to prevent over modulation operation at unfavorable grid scenarios. The flexible control retains the grid power quality at severe unbalanced voltage conditions. The system operation is resilient to fluctuations in the PVA power, load currents or the grid voltages. The fast assessment of the load current weights prevents DC link voltage deviations at load fluctuations. The system capability at challenging operating scenarios, is presented for the system validation.

# CONCLUSION

The resilient operation of the grid connected PV system at weak grid conditions has been demonstrated. The two stage GVF has removed the harmful influence of non-ideal and weak grid from the currents regulated by the system, leading to distortion-free and balanced grid currents at challenging grid scenarios. The improved power quality using the presented DC link voltage control over the conventional and the conventional adaptive methods, has been demonstrated. The prevention of over modulation

# CONCLUSION

The resilient operation of the grid connected PV system at weak grid conditions has been demonstrated. The two stage GVF has removed the harmful influence of non-ideal and weak grid from the currents regulated by the system, leading to distortion-free and balanced grid currents at challenging grid scenarios. The improved power quality using the presented DC link voltage control over the conventional and the conventional adaptive methods, has been demonstrated. The prevention of over modulation is successfully achieved. The system power quality enhancement aspects have been validated at rapid load changes, nonlinear loading case, PVA power variations and at absence of PVA power.

# DOUBLE STAGE SOLAR PV ARRAY INTEGRATED UPQC FOR THREE PHASE FOUR WIRE DISTRIBUTION SYSTEM

A Major project report
Submitted in partial fulfilment of
The requirements for the award of the degree of
**BACHELOR OF TECHNOLOGY**
in
**ELECTRICAL & ELECTRONICS ENGINEERING**

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This is to certify that the major project report entitled **DOUBLE STAGE SOLAR PV ARRAY INTEGRATED UPQC FOR THREE PHASE FOUR WIRE DISTRIBUTION SYSTEM** submitted by the following students in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in EEE, and is a bonafide record of the work performed by

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# ABSTRACT

The double stage solar photovoltaic (SPV) array integrated four wire unified power quality conditioner (UPQC) system is presented for three phase four wire distribution network. The control of four wire UPQC-PV system is done to eliminate the voltage and current power qualities (PQs) problems like neutral current, harmonics, reactive power, voltage sag, voltage swell, voltage unbalanced, etc. The four wire UPQC-PV system consists of two four legs voltage source inverters (VSIs) connected back-to-back through common DC bus. The four wire UPQC-PV system is modelled in the Simulink/MATLAB, and its results are presented for analysis for various instances, unbalancing of load, unbalanced voltage sag and swell, solar irradiation variation, etc. The system performs effectively for such conditions and the current and voltage PQs problems are simultaneously improved. The load side voltages and the grid currents total harmonic distortions (THDs) are within the limits of the IEEE-519 standard.

# CONCLUSION

A four wire unified power quality conditioner integrated double stage solar PV array is presented for improving steady and dynamic performances. This presented system has the following features: (1) the load voltages amplitude are constant (within the threshold limits stated in the IEEE-1159 standard) and balanced even for balanced and unbalanced grid voltages swell/sag; (2) synchronization tool such as phase locked loop is exempted in the control algorithm and this makes the presented system reliable for various abnormalities in grid; (3) the THD of the load voltages and the grid currents are found in the limits of the IEEE-519 standard. The grid currents are balanced and sinusoidal in all the three phases as well as the neutral current is zero, even under balanced or unbalanced grid voltages sag and swell, nonlinear loads, load currents unbalanced condition and variation in solar insolation. Obtained results are presented and discussed. The system performance is found satisfactory while improving the power qualities of four wire distribution network.

# A BATTERY-ENERGY-STORAGE-BASED DC DYNAMIC VOLTAGE RESTORER FOR DC RENEWABLE POWER PROTECTION

A Major project (Stage-II) report
Submitted in partial fulfilment of
The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

in

**ELECTRICAL & ELECTRONICS ENGINEERING**

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This is to certify that the major project(Stage-II) report entitled **A BATTERY-ENERGY-STORAGE-BASED DC DYNAMIC VOLTAGE RESTORER FOR DC RENEWABLE POWER PROTECTION** submitted by the following students in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in EEE, and is a bonafide record of the work performed by

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# ABSTRACT

The limitation of the DC protection device confines the development of MV/LVDC grids. This paper presents a DC dynamic voltage restorer to exploit DC custom power devices for DC distribution networks in principle. It is based on an improved AC/DC dual active bridge and battery energy storage to maintain the voltage profile of sensitive loads in DC networks. The principle of the improved DC-DVR has been analyzed from the perspectives of the range of compensated voltage, current characteristics, and control strategy. Compared with other existing methods, the proposed DC-DVR features a simple structure, an easy control strategy, and the ability to mitigate both voltage sag and swell by injecting forward or reverse voltage. Experiment results demonstrate the correctness of the theoretical analysis and the feasibility of the proposed structure. A case study of DC doubly-fed induction generator (DFIG) interfaced with power grid is carried out, integrated with the proposed DC-DVR to verify the operation principle of the proposed scheme.

# CONCLUSION

This project presents a BES-based DC-DVR to compensate the negative effect of voltage sag/swell events on sensitive loads in DC networks. A modified AC/DC DAB has been adopted and modeled to implement the bidirectional compensation in the proposed DC-DVR. The circuit principle of the modified DAB facilitating the forward and inverse voltage compensation has been investigated in detail.

Experimental analysis has been implemented to verify the effectiveness of the proposed DC-DVR under voltage sag/swell conditions. To further extend the application of the proposed DC-DVR, modeling of the DFIG-DC system has been carried out with consideration of its characteristics under DC voltage faults, as well as simulation implemented for synthetical investigation. Simulation and experimental

# CONCLUSION

This project presents a BES-based DC-DVR to compensate the negative effect of voltage sag/swell events on sensitive loads in DC networks. A modified AC/DC DAB has been adopted and modeled to implement the bidirectional compensation in the proposed DC-DVR. The circuit principle of the modified DAB facilitating the forward and inverse voltage compensation has been investigated in detail.

Experimental analysis has been implemented to verify the effectiveness of the proposed DC-DVR under voltage sag/swell conditions. To further extend the application of the proposed DC-DVR, modeling of the DFIG-DC system has been carried out with consideration of its characteristics under DC voltage faults, as well as simulation implemented for synthetical investigation. Simulation and experimental results agree with the theoretical analysis, validating the robustness and feasibility of the proposed approach.

Conclusively, the proposed scheme has several outstanding features by horizontally comparing with other existing DC protection devices:

1) A more straightforward structure;

2) A more concise control strategy;

3) A low manufacturing cost;

4) An extensive compensation range for voltage sag and swell.

# A BIDIRECTIONAL ON-BOARD CHARGING SYSTEM FOR LEVS

A

Major Project (Stage-I) report submitted in partial fulfilment of

the requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

In

**ELECTRICAL AND ELECTRONICS ENGINEERING**

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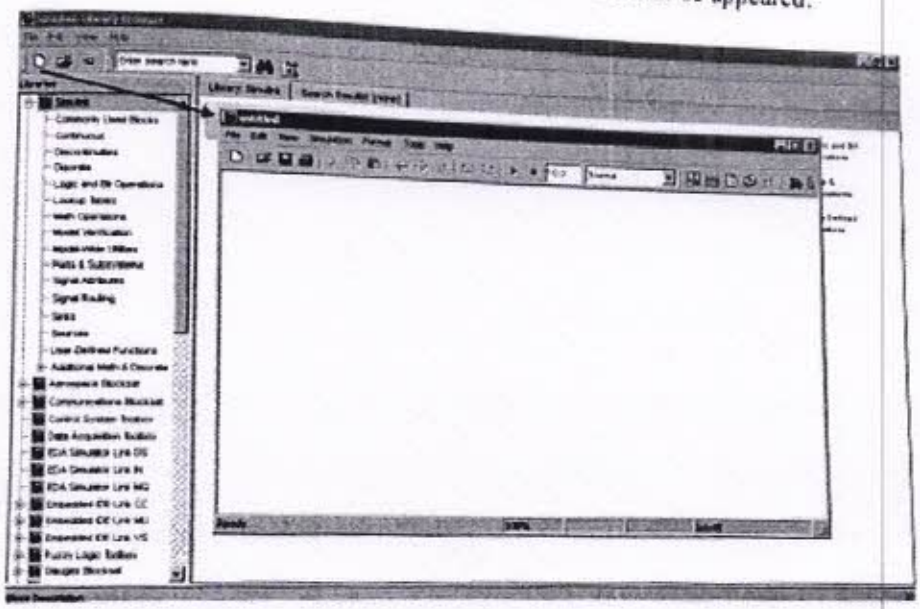
# ABSTRACT

The unidirectional power flow capability of the existing light electric vehicle (LEV) charging systems limits their contribution in today's smart grid scenario and consequently imposes a major obstacle in their future growth. Further, such a charging system includes several other shortcomings such as compromised supply and battery side performance, high volume, and low efficiency. Therefore, a bidirectional onboard charger topology with high-performance characteristics both from supply and battery side perspectives is presented in this work for the LEVs. It is noteworthy that, the presented topology not only ensures effective charging from the grid but also owns a capability to meet grid demands as per the requirement of the distributors. In order to accomplish unity displacement and distortion factor at the supply while carrying out ripple free charging/discharging of the battery, a two-stage structure comprising AC-DC and DC-DC stages, is effectively utilized. Unlike conventional approaches, the presented topology utilizes a non-isolated bidirectional switched inductor buck-boost (BSIBB) converter at the DC-DC stage. The high gain capability of the presented BSIBB converter enables the desired voltage gain between DC link and battery packs and, therefore, eliminates the requirement of transformers at the DC-to-DC stage. Finally, the acceptability of the charger for the LEVs charging is verified through design and performance analyses.

- Time-domain signal detection based on second-order statistics for mimo-OFDMsystems
- Space–time block coding
- Space–time block codes for mimo channels
- Blind channel estimation

## 3.9 BASIC CIRCUIT DESIGNING AND ANALYZING OF RESULTS

Click on the file and select new model file and a file will be appeared:



Now a block and right click on it, the block will be appearing in the new model file(untitled)

For example, consider a sine wave in the source block and in order to obtainor to view the output place the scope block. Join those two blocks. Now a simple circuit is ready, now set the simulation time in the tool bar (default it is set to 10.0),simulate the circuit by clicking on the simulation icon (PLAY BUTTON). Simulation is completed now by double clicking on the scope u can view the output,press the auto scale button and o/p will appear clearly.

# SRF THEORY-BASED PI CONTROLLER APPLIED TO MICRO GRID INTERFACED WITH HYBRID SOURCES FOR POWER QUALITY IMPROVEMENT

A Major project Stage-I report
Submitted in partial fulfilment of
The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

in

**ELECTRICAL & ELECTRONICS ENGINEERING**

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# ABSTRACT

The importance of the Micro grid is increasing day to day because of reducing transmission cost, in comparison to the grid, microgrids have more renewable energy sources and it is easier to spot faults. If the main grid goes down, the microgrid can keep consumers comfortable by supplying power to homes and businesses for a while. The microgrid is best suitable in hilly areas and remote locations. Microgrid delivers important loads with a high-quality, consistent energy supply.

This project presents a Power quality improvement in Micro Grid used SRF theory. The microgrid is the interconnection of hybrid sources and load. The hybrid sources are PV cell, Fuel Cell, and Super Capacitor. By integrating these small sources, microgrids are implemented in generating the electrical power at load demand. The voltage and reactive power support to the external grid are examined using STATCOM deployed at various locations throughout the microgrid. The simulation results were verified in MATLAB/ SIMULINK software.

So, in this project stage -1 we have done up to literature survey and have studied about the matlab software. In the stage-2 of final documentation we are going to do simulation software and respected results.

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# A ROBUST IMFOGI CONTROL FOR POWER QUALITY ENHANCEMENT OF A DUAL STAGE SPV-BES-BDC SYRG DG SET BASED STANDALONE MICROGRID

A Major project Stage-I report
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**ELECTRICAL & ELECTRONICS ENGINEERING**

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# ABSTRACT

This project focuses on the power quality improvement of a diesel generator (DG) in a standalone microgrid, in presence of local nonlinear loads that draw nonlinear currents. A standalone system comprising of a dual stage solar photovoltaic (SPV) array, battery energy storage (BES) interfaced with a bidirectional converter (BDC), and a synchronous reluctance DG set is considered in this work. An improved mixed fifth-order generalized integrator (IMFOGI) based control algorithm is presented for control of the voltage source converter (VSC) of the SPV array. The IMFOGI control has enhanced filtering ability and it eliminates the dominant harmonic components and DC offsets from the load currents and point of common coupling (PCC) voltages and makes the DG set currents and voltages sinusoidal, even in the presence of nonlinear three-phase and single-phase loads. To extract maximum power from the SPV array, it is controlled by the incremental conductance (INC) algorithm. The DG set is run in the fuel economy zone (FEZ) for maximum fuel efficiency. The system performance with the presented IMFOGI control is analyzed in steady-state and dynamic conditions, in both simulation and hardware, using a Simulink model and experimental setup of the system prototype, respectively

So, in this project stage -1 we have done up to literature survey and have studied about the matlab software. In the stage-2 of final documentation we are going to do simulation software and respected results.

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# +BLDCM CELLING FAN WITH SWITCHED INDUCTOR CUK CONVERTER

A Major project (Stage-II) report
Submitted in partial fulfilment of
The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

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**ELECTRICAL & ELECTRONICS ENGINEERING**

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# ABSTRACT

This project presents the switched-inductor Cuk (SI Cuk) converter fed permanent magnet brushless direct current motor (PMBLDCM) to get the unity power factor (UPF) operation at the supply input. The SI-Cuk converter is used as a front-end to deal with the existing CF's power quality (PQ) problems. The SI-Cuk converter is designed to operate in discontinuous conduction mode (DCM) to produce the variable output with inherent power factor correction (PFC). The converter voltage output is estimated with a potential divider. The reference voltage is estimated from the CF reference speed to generate the high frequency PWM pulses for the converter switch, reducing the required sensors and cost. The variable voltage output of the converter offers the inverter to operate at commutation frequency, which minimizes the inverter losses and improves the CF efficiency. The back-EMF sensorless control eliminates the required position sensors, which further reduces the cost of CF. To confirm the design of SI-Cuk converter, simulated results are shown in the result section.

# CONCLUSIONS

The PMBLDCM based CF performances with SI-Cuk converter are analyzed here. The controller has performed well with changes in supply and converter output voltages. The PQIs at supply input are quite good. It has verified the converter design and controller performances. The converter operates with a high switching frequency, which reduces the size of used passive components. The speed control with variable converter voltage output provides the inverter operation at commutation frequency, reducing the switching losses and improving CF efficiency. The sensorless control of converter and motor lowers the cost of CF.

# CONSTRUCTION AND PERFORMANCE INVESTIGATIONOF THREE-PHASE SOLAR PV AND BATTERY ENERGY STORAGE SYSTEM INTEGRATED UPQC

A Major project (Stage-II) reportSubmitted in partial fulfillment of
The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

*in*

**ELECTRICAL AND ELECTRONICS ENGINEERING**

by


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*Under the Esteemed guidance of*
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## CERTIFICATE

This is to certify that the major project (stage-II) report entitled **"CONSTRUCTION AND PERFORMANCE INVESTIGATION OF THREE-PHASE SOLAR PV AND BATTERY ENERGY STORAGE SYSTEM INTEGRATED UPQC** "submitted by the following students in partial fulfillment of the requirements for the award of the Degree of **Bachelor of Technology** in **EEE**, and is a bonafide record of the work performed by

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# ABSTRACT

This study examines the use of Unified Power Quality Conditioner (UPQC) to mitigate the power quality problems existed in the grid and the harmonics penetrated by the non-linear loads. The UPQC is supported by the Photovoltaic (PV) and Battery Energy Storage System (BESS) in this work. Generally, the PV system supplies the active power to the load. However, if the PV is unable to supply the power then the BESS activates and provides power especially during the longer-term voltage interruption. The standalone PV-UPQC system is less reliable compared to a hybrid PV-BESS system because of its instability and high environment-dependency. Therefore, BESS will improve the voltage support capability continuously in the longer-term, reduce the complexity of the DC-link voltage regulation algorithm, and keep producing clean energy. The phase synchronization operation of the UPQC controller is directed by a self-tuning filter (STF) integrated with the unit vector generator (UVG) technique. Implementation of STF will make sure the UPQC can successfully operate under unbalanced and distorted grid voltage conditions. Thus, the requirement of a phase-locked loop (PLL) is omitted and the STF-UVG is utilized to produce the synchronization phases for the series and shunt active power filter (APF) compensator in UPQC controller. Finally, the proposed STF UVG method is compared with the conventional synchronous references frame (SRF-PLL) method based UPQC to show the significance of the proposed technique. Several case studies are further considered to validate the study in MATLAB-Simulink software.

# CONCLUSION

The construction of three-phase UPQC has been investigated considering thecondition of complex power quality problems which are an amalgamation of harmonics, voltage swell, and sags, and voltage interruption under unbalanced and distorted voltage grid condition. Integrating the BESS and PV with the UPQC provides active power capability tothe network. The main benefit of BESS integrated with UPQC is that it makes the system capable of supplying and absorbing active power from the PV. Since renewable energy is not completely reliable because of its environment-dependent feature, integrating a BESS will solve the lack of renewable energy resources. Finally, it can be figured that the BESS and PV attached with UPQC can be a good alternative in the distributed generation to upgrade the power quality of the contemporary distribution system. The DC-link voltage is stable becauseof the continuous supply from the PV-BESS system. Therefore, it can reduce the complexity of the DC-link voltage regulation algorithm. The STF-UVG technique for synchronization phases is applied successfully in the shunt and series APF compensator to generate reference current and voltage. Thus, the UPQC is designed without relying on the PLL components, and mitigation of current and voltage are achieved successfully following the grid condition to ensure the system stability and to achieve almost unity power factor. The implementation of the proposed technique has confirmed that the grid current harmonics follow the IEEE-519 standard. Finally, it is worth mentioning that the proposed system can enhance the overall efficiency of the grid power system.

# CONTROL OF PHOTOVOLTAIC INVERTERS FOR TRASIENT AND VOLTAGE STABILITY ENHANCEMENT

A Major project Stage-II report

Submitted in partial fulfilment of

The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

in

**ELECTRICAL & ELECTRONICS ENGINEERING**

By


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# ABSTRACT

The increasing number of megawatt-scale photovoltaic (PV) power plants and large inverter-based power stations that are being added to the power system are leading to changes in the way the power grid is operated. In response to these changes, new grid code requirements establish that inverter based power stations should not only remain connected to the grid during faulty conditions but, also provide dynamic support. This feature is referred in the literature to as momentary cessation operation. The few published studies about momentary cessation operation for PV power plants have not shed much light on the impact of these systems on the overall power system stability problem. As an attempt to address this issue, this paper proposes a control scheme for PV inverters that improves the transient stability of a synchronous generator connected to the grid. It is shown through the paper that the proposed control scheme makes the PVinverter's dc link capacitors absorb some of the kinetic energy stored in the synchronous machine during momentary cessation. Besides that, the proposed solution is also able to improve voltage stability through the injection of reactive power. Experimental and simulation results are presented in order to demonstrate the effectiveness of the proposed control scheme.

# CHAPTER 7

# CONCLUSION

In the present state the Electricity has become the driving force of all key factors that is having most important impact in the life of mankind. Even the principle for developed country or budding country reports the electricity consumption per capita. In the last few decades the rapidity of demand of electricity & its generation does not match the transmission system. So there is huge overcrowding in the transmission system presently. That is the reason now a day incorporation of renewable source of energy with the grid close to the location of load. In this work, a manage scheme for PV inverters is proposed to behave all through faults that could compromise the transient and voltage stability of a hybrid electricity machine. The proposed manipulate scheme makes the SM kinetic power to be absorbed into the dc link capacitors to improve transient stability. Besides that, it also permits the injection of reactive energy into the grid to guide voltage balance.

# ROBUST CONTROL FOR ROOFTOP SOLAR PV-BES MICROGRID AND ITS SEAMLESS GRID SYNCHRONIZATION

A

Major Project (Stage-I) report

submitted in partial fulfilment of

the requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

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# ABSTRACT

This research work targets on synchronization of single-stage solar photovoltaic (SPV)-battery energy storage (BES) based microgrid with the power grid. This system provides seamless synchronization between on-grid and off grid modes of operation, power quality (PQ) improvements, frequency variation mitigation, operation under polluted grid conditions, and unbalanced load compensation. This system uses a dual-third order generalized integrator-reduced order generalized integrator-frequency locked loop (dual-TOGI ROGI-FLL) to realize seamless switching between on-grid and off-grid modes of operation with a solid-state transfer switch (SSTS). A TOGI-quadrature signal generator (TOGI-QSG) based current controlled algorithm provides gating pulses to the VSC during the on-grid mode. A voltage-controlled algorithm is used during the off-grid mode of operation. A comparison of filtering ability between DTOGI-ROGI-FLL and SOGI-FLL during distorted grid conditions is made. Satisfactory results of MATLAB simulations in both dynamic and steady-state conditions validate the system's performance.

In this Major Project (Stage-I) of our project title described as **Robust control for rooftop solar PV-BES microgrid and its seamless grid synchronization** converters solar energy into electricty and it is economic,the future depends on renewable energy's by the use of solar energy we can receive enough electricity that can use for the needs of every human being. So far in this Major project (stage-I) we have done up to literature survey and about the Matlab software. The Matlab we used to design the circuit in this project. In the Major project(stage-II) of final documentation we are going to do simulation software and respected results.

# BIDIRECTIONAL ISOLATED DC/DC DUAL-ACTIVE-BRIDGE CONVERTERS OPTIMUM SOFT-SWITCHING CONTROL METHOD FOR ELECTRICAL VEHICLE APPLICATIONS

A

Major Project (Stage-I) report

submitted in partial fulfilment of

the requirements for the award of the degree of

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# ABSTRACT

Electrical vehicles (EV) are appropriate alternative to the conventional internal combustion engines. The conventional grid-connected EV chargers consist of an AC/DC power-factor correction (PFC) converter, and an isolated DC/DC converter connected to the battery. The isolated DC/DC converter can be used as a bidirectional converter providing power to the grid in the peak hours. During the entire charging process of the EV battery, the voltage varies significantly, and the DC/DC converter should operate under wide input and output voltage range. In this paper, the bidirectional dual-active-bridge (DAB) converter with both full-bridge and half-bridge topologies is studied. In the light-load condition, the zero-voltage-switching (ZVS) cannot be attained. Thus, a switching control method with emphasis on variable frequency and duty-cycle (VFD) is suggested at light-loads to improve overall efficiency of the DAB converters. Simulation results verifies the accuracy of this method.

In this Major Project (Stage-I) of our project title described as Bidirectional isolated DC/DC dual-active-bridge (DAB) converters are widely used in electrical vehicle (EV) applications to enable efficient power transfer between the high voltage battery and the low-voltage auxiliary systems. Optimum soft-switching control methods can be employed to improve the converter's efficiency and reduce the switching losses. The Matlab, we used to design the circuit in this project. The basics we had learnt from this Major project (Stage-I), and the simulation will be presented in the Major project (Stage-II).

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# HIGH-EFFICIENCY SINGLE-STAGE ON-BOARD CHARGER FOR ELECTRICAL VEHICLES

*A Major project (Stage-II) report*
*Submitted in partial fulfilment of*
*The requirements for the award of the degree of*

**BACHELOR OF TECHNOLOGY**

in

**ELECTRICAL & ELECTRONICS ENGINEERING**

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# ABSTRACT

This paper presents an isolated single-stage on-board electric vehicle charger without an intermediate DC-link. Based on an isolated current-source topology, the converter features soft switching in semiconductors regardless of load variation for the full AC line voltage range. Moreover, it requires no external snubber or clamp circuits. The power factor correction and voltage regulation are provided by a relatively simple phase shift modulation, while the amount of circulating energy is kept at minimum. The charger is distinguished by its efficiency characteristic – the maximum is achieved in the constant power charging mode. The control method, component stresses, and design constraints of the topology are analyzed. The concept is verified using a 3 kW experimental SiC-based prototype, which reaches a peak efficiency of 96.4%. Moreover, the charger has demonstrated efficiencies above 95% with the THD of 4.1% when operating in constant power mode at the maximal power.

# CHAPTER 10
# CONCLUSION

This project proposed an AC-DC current source converter for the OBC application, taking advantage of the single-stage energy conversion. The design guidelines were presented and experimentally verified using a 3kW prototype. PFC functionality was implemented, utilizing the simple single phase-shift modulation method.

Thus, the charger control system does not require high-performance processing and low-latency sensors for proper operation. It was demonstrated that the

# CHAPTER 10
# CONCLUSION

This project proposed an AC-DC current source converter for the OBC application, taking advantage of the single-stage energy conversion. The design guidelines were presented and experimentally verified using a 3kW prototype. PFC functionality was implemented, utilizing the simple single phase-shift modulation method.

Thus, the charger control system does not require high-performance processing and low-latency sensors for proper operation. It was demonstrated that the THD of the converter does not exceed 5%, which satisfies the IEC 61000-2-2 standard. The soft-switching capabilities of the converter were experimentally verified for the primary and secondary side transistors. Another noticeable benefit of the topology is low RMS currents in the transformer. The charger features an efficiency change trend that is inverse to the output voltage, which is natural for single-stage boost-type current-source converters.

Taking into account the features of the charging profile of Li-ion batteries, the converter demonstrates performance comparable to the state-of-the-art two-stage solutions for OBC applications. The converter efficiency during charging is around 95% during most of the battery charging process. Future research will focus on the bidirectional operation capability of the proposed topology and multi-cell A-SMC OBC design for high-power charging applications.

# A BIDIRECTIONAL ON-BOARD CHARGING SYSTEM FOR LEVS

A

Major Project (Stage-I) report submitted in partial fulfilment of

the requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

In

**ELECTRICAL AND ELECTRONICS ENGINEERING**

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# ABSTRACT

The unidirectional power flow capability of the existing light electric vehicle (LEV) charging systems limits their contribution in today's smart grid scenario and consequently imposes a major obstacle in their future growth. Further, such a charging system includes several other shortcomings such as compromised supply and battery side performance, high volume, and low efficiency. Therefore, a bidirectional onboard charger topology with high-performance characteristics both from supply and battery side perspectives is presented in this work for the LEVs. It is noteworthy that, the presented topology not only ensures effective charging from the grid but also owns a capability to meet grid demands as per the requirement of the distributors. In order to accomplish unity displacement and distortion factor at the supply while carrying out ripple free charging/discharging of the battery, a two-stage structure comprising AC-DC and DC-DC stages, is effectively utilized. Unlike conventional approaches, the presented topology utilizes a non-isolated bidirectional switched inductor buck-boost (BSIBB) converter at the DC-DC stage. The high gain capability of the presented BSIBB converter enables the desired voltage gain between DC link and battery packs and, therefore, eliminates the requirement of transformers at the DC-to-DC stage. Finally, the acceptability of the charger for the LEVs charging is verified through design and performance analyses.

In this Major Project (Stage-I) of our project title described as **A Bidirectional on-board charging system for LEVs.** The unidirectional power flow capability of the existing light electric vehicle (LEV) charging systems limits their contribution in today's smart grid scenario and consequently imposes a major obstacle in their future growth. Further, such a charging system includes several other shortcomings such as compromised supply and battery side performance, high volume, and low efficiency. So far in this Major project (stage-I) wehave done up to literature survey and about the Matlab software. The Matlab we used to design the circuit in this project. In the Major project(stage-II) of final documentation we are going to do simulation software and respected results.

# ANALYSIS, MODELING AND IMPLEMENTATION OF A SWITCHING BI-DIRECTIONAL BUCK-BOOST CONVERTER BASED ON ELECTRIC VEHICLE HYBRID ENERGY STORAGE FOR V2G SYSTEM

A Major project Stage-I report
Submitted in partial fulfilment of
The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

in

**ELECTRICAL & ELECTRONICS ENGINEERING**

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## Department of Electrical and Electronics Engineering

## CERTIFICATE

This is to certify that the major project Stage-I report entitled **ANALYSIS, MODELING AND IMPLEMENTATION OF A SWITCHING BI-DIRECTIONAL BUCK-BOOST CONVERTER BASED ON ELECTRIC VEHICLE HYBRID ENERGY STORAGE FOR V2G SYSTEM** submitted by the following students in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in EEE, and is a bonafide record of the work performed by

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# ABSTRACT

This paper presents a switching bi-directional buck-boost converter (SBBBC) for vehiclesto-grid (V2G) system. The topology can provide an energy bi-directional flow path for energy exchange between the Li-battery/super capacitor (SC) hybrid energy storage system (HESS) of the electric vehicle and the grid. This topology not only has buck-boost capability, but also has the function of energy management. In this paper, the state-space averaging method is used to analyse the stability of the topology in boost and buck modes. The control strategy is given according to the state of charge (SOC) of the energy storage system to ensure that the output voltage and current are stable. And the Li-battery is charged in constant current (CC) and constant voltage (CV) mode. In addition to a soft switched DC-DC conversion, the circuit also facilitates an additional output which makes the system capable of supporting multiple applications. The circuit under discussion uses fuzzy logic for the closed loop operation which has better overall performance compared to other conventional converters. Finally, the electrical feasibility of the topology, the suitability of the design controller and control strategy are verified by simulation and experiment.

*So for in this project stage -1 we have done up to literature survey and about the Matlab software. In the Stage -2 of final documentation we going to do simulation software and respected results.*

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# CASCADED MULTILEVEL INVERTER BASED POWER AND SIGNAL MULTIPLEX TRANSMISSION FOR ELECTRIC VEHICLES

A

Major Project (Stage-I) report

submitted in partial fulfilment of

the requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

in

**ELECTRICAL AND ELECTRONICS ENGINEERING**

by


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**Ramakrishna colony, Karimnagar-505527**


**(2019-2023)**



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**Department of Electrical and Electronics Engineering**

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## CERTIFICATE

This is Certify to that the Major Project (Stage1) report entitled **"CASCADED MULTILEVEL INVERTER BASED POWER AND SIGNAL MULTIPLEX TRANSMISSION FOR ELECTRIC VEHICLE"** submitted by the following students in partial fulfilment of the requirements for the award of the Degree of Bachelor of Technology in EEE, and is a bonafied record of the work performed by

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The work embodied in this Major project (Stage1) report has not been submitted to anyother institution for the award of any degree.

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## ABSTRACT

Power & signal multiplex transmission (P&SMT) is a technique that uses power electronic circuits for communication signal transmission. In this paper, a three-phase cascaded multilevel inverter-based P&S MT system is proposed. The proposed method can transmit communication signals without using a Controller Area Network bus, thereby reducing the wiring cost of the conventional electric vehicle (EV) communication system. The designed system can achieve motor speed regulation and battery balance discharging for EVs. With the combined pulse width modulation scheme and frequency shift keying method, both power and communication signals are transmitted successfully in a simulation model implemented in Matlab /Simulink. By evaluating the bit error rate of the transmitted signal, the maximum signal rate of the proposed system is determined as 600 bit/s.



Index Terms—Battery state of charge, controller area network, frequency shift keying, motor speed control, pulse width modulation, three-phase DC-AC converter.

In this Major Project (Stage-I) of our project title described as **CASCADED MULTILEVEL INVERTER BASED POWER AND SIGNAL MULTIPLEX TRANSMISSION FOR ELECTRIC YEHICLE.** In this a three-phase cascaded multilevel inverter-based P&S MT system is proposed. The proposed method can transmit communication signals without using a Controller Area Network bus, thereby reducing the wiring cost of the conventional electric vehicle (EV) communication system. The designed system can achieve motor speed regulation and battery balance discharging for EVs. So far in this Major project (stage-I) wehave done up to literature survey and about the Matlab software. The Matlab we used to design the circuit in this project. In the Major project(stage-II) of final documentation we are going to do simulation software and respected results.

# A SIMPLE AND RECONFIGURABLE WIRELESS POWER TRANSFER SYSTEM WITH CONSTANT VOLTAGE AND CONSTANT CURRENT CHARGING

A Major project report
Submitted in partial fulfillment of
The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

*in*

**ELECTRICAL AND ELECTRONICS ENGINEERING**

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# ABSTRACT

A typical charging profile for the Li-ion batteries in electric vehicles (EVs) includes a constant current (CC) charging stage and a constant voltage (CV) charging. This letter proposes a simple and reconfigurable topology for CC and CV outputs in an EV wireless charging system. The proposed system can be switched to series–series topology for CC output and inductor–capacitor– capacitor-series topology for CV output. Only one relay is introduced, unlike existing solutions where many passive components and relays are utilized for reconfiguration. Also, there is no need for frequency variation to achieve the shift of CC and CV. An experimental prototype is implemented to validate the proposal.

# CONCLUSION

This letter proposed a simple and reconfigurable topology for CC and CV outputs in a wireless charging system. The LCC-S topology can be reconfigured to the S–S topology by using the three resonant loops. Unlike the existing solutions where many passive elements and relays are utilized, the proposed solution only adopts a relay, and no extra inductors or capacitors are introduced compared with the LCC-S topology. In addition, the system works at one single frequency, easily complying with existing standards. A prototype was developed. The experimental results validated the effectiveness of the proposed system.

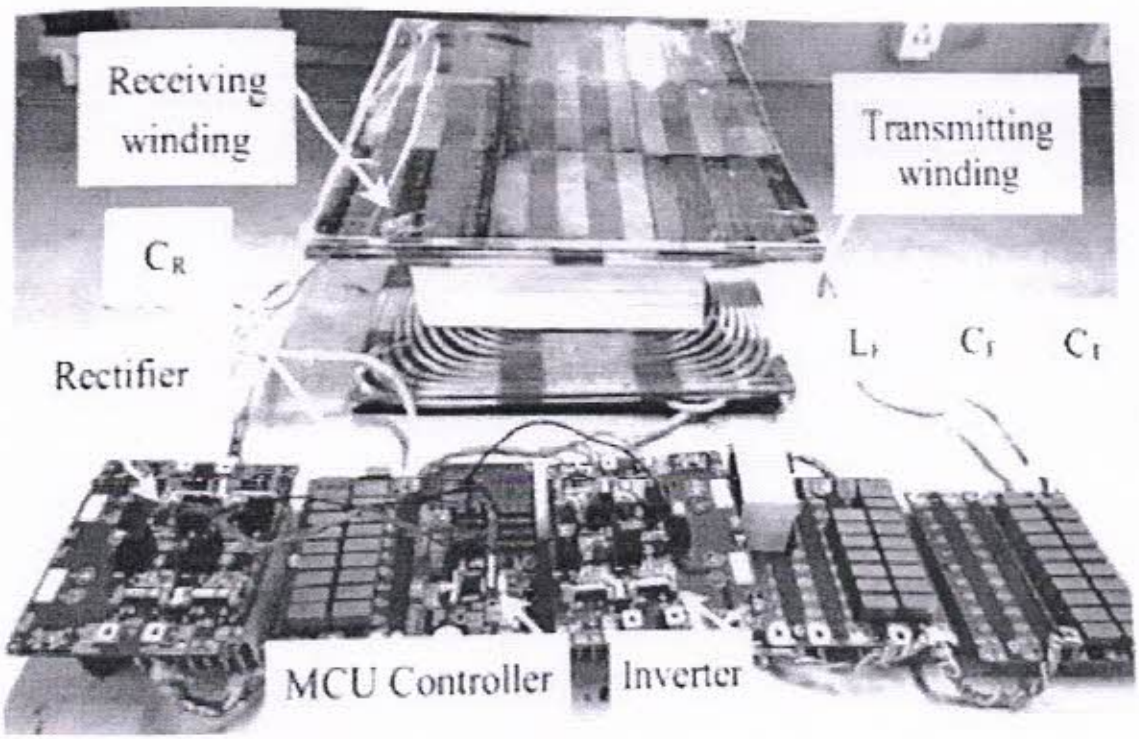


Fig 8.3: Photograph of the Experimental Prototype.

# DESIGN OF ULTRA-FAST ELECTRIC VEHICLE BATTERY CHARGER

A major project report submitted in partial fulfillment of the requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

**in**

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# DESIGN OF ULTRA-FAST ELECTRIC VEHICLE BATTERY CHARGER

A major project report submitted in partial fulfillment of the requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

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This is to certify that the major report entitled **"Design of Ultra-Fast Electric Vehicle Battery Charger"** submitted by the following students, in partial fulfillment of the requirements for the award of Degree of Bachelor of Technology in Electrical & Electronics Engineering, and is a bonafide record of the work performed by the following students.

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# ABSTRACT

The demand for finding solutions to charge EVs as quickly as filling a fuel tank of an Internal Combustion Engine (ICE) vehicle increases. In this paper, the performance of a 2kW Cuk converter operating in Continuous Conduction Mode (CCM) and Discontinuous Inductor Conduction Mode (DICM) are assessed for Ultra-Fast Charging (UFC) of low voltage EV batteries such as the one used in golf carts. Besides, state-space modeling for the Cuk converter operating in DICM is carried out to design the output current controller. The designs were simulated and verified using MATLAB/Simulink, and the results show that the size and the complexity of the controller can be reduced when the Cuk converter operates in DICM, meeting the requirements of international standards.

# CHAPTER 8

# CONCLUSION

To conclude, a Cuk converter operating in DICM was modeled and analyzed to be used as an Ultra-Fast Charger for low voltage batteries such as the one used in golf carts. The state-space modeling of the Cuk converter in DICM shows a satisfactory agreement with the simulated circuit. Besides, the performance of the two Cuk converters operating in CCM and DICM were compared, and it was noted that the DICM operation is more suitable for the design of Ultra-fast Chargers because it could satisfy the international input power quality standards while keeping the size of the charger small and by using only a simple controller.

# SRF THEORY-BASED PI CONTROLLER APPLIED TO MICRO GRID INTERFACED WITH HYBRID SOURCES FOR POWER QUALITY IMPROVEMENT

A Major project Stage-II report
Submitted in partial fulfilment of
The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

in

**ELECTRICAL & ELECTRONICS ENGINEERING**

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This is to certify that the major project Stage-II report entitled **SRF THEORY-BASED PI CONTROLLER APPLIED TO MICRO GRID INTERFACED WITH HYBRID SOURCES FOR POWER QUALITY IMPROVEMENT** submitted by the following students in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in EEE, and is a bonafide record of the work performed by

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# ABSTRACT

The importance of the Micro grid is increasing day to day because of reducing transmission cost, in comparison to the grid, microgrids have more renewable energy sources and it is easier to spot faults. If the main grid goes down, the microgrid can keep consumers comfortable by supplying power to homes and businesses for a while. The microgrid is best suitable in hilly areas and remote locations. Microgrid delivers important loads with a high-quality, consistent energy supply.

This project presents a Power quality improvement in Micro Grid used SRF theory. The microgrid is the interconnection of hybrid sources and load. The hybrid sources are PV cell, Fuel Cell, and Super Capacitor. By integrating these small sources, microgrids are implemented in generating the electrical power at load demand. The voltage and reactive power support to the external grid are examined using STATCOM deployed at various locations throughout the microgrid. The simulation results were verified in MATLAB/ SIMULINK software.

# CONCLUSION

This project presents the power quality integration of microgrids. The microgrid is an interconnection hybrid energy source and nonlinear load. In this project, the inverter converts hybrid DC sources to AC sources. The hybrid energy sources are solar, battery and ultra-capacitor. This project improved power quality on the source side. This project uses a PI controller to control the supply voltage and supply current. The proposed controller maintained low THD. The simulation results verified Matlab/Simulink software and the obtained THD value at the supply-side less than 10%.