# DESIGN OF ULTRA-FAST ELECTRIC VEHICLE BATTERY CHARGER

A

**Major project (Stage II) report**

Submitted 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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# ABSTRACT

As the world move towards using Electric Vehicles (EVs) as a sustainable way of commuting, 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 project, the performance of a 2KW Cuk converter operating in Continuous Conduction Mode (CCM) is assessed for Ultra-Fast Charging (UFC) of low voltage EV batteries such as the one used in golf carts. The designs were simulated and verified using MATLAB/Simulink, and the results show that the size and the complexity of the controller can be verified when the Cuk converter operates in CCM, meeting the requirements of international standards.

# CONCLUSION

One of the known challenges when designing a Cuk converter connected to a full-wave rectifier is maintaining the system's power quality while keeping the design small. This section studies the performance of a 2kW controlled Cuk converter operating in CCM and DICM. Table III shows the design parameters used to obtain the results shown in fig. 6 and fig. 7. Both systems are designed to meet the IEEE 519-2014 standards (THD<5%) [12] and to have a low output current ripple.

In CCM, a PFC controller, which has two PI controllers, is used to maintain the power quality [18].

While in DICM, a simple output current controller is needed thanks to the current shaping property of the Cuk converter when operating in DICM [15]. It is worth noting that the charger's size can significantly drop because smaller component.

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.

# "A HIGH EFFICIENCY NON ISOLATED BUCK-BOOST CONVERTER BASED ON ZETA CONVERTER"

*A*

*Major Project(Stage 1) report*

*submitted in partial fulfillment of*

*The requirements for the award of the degree of*

**BACHELOR OF TECHNOLOGY**

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# ABSTRACT

A new transformerless buck– boost converter based on a ZETA converter is introduced. The proposed converter has the ZETA converter advantages, such as buck–boost capability, input-to-output dc insulation, and continuous output current. The suggested converter voltage gain is higher than the classic ZETA converter. In the presented converter, only one main switch is utilized. The proposed converter offers low voltage stress of the switch; therefore, the low ON-state resistance of the main switch can be selected to decrease the losses of the switch. The presented converter topology is simple; hence, the control of the converter is simple. The converter has the continuous output current. The mathematical analyses of the presented converter are given. The experimental results confirm the correctness of the analysis.

## Conclusion:

Conventionally, separate dc–dc converters are used to interface different sources or storage elements with a common dc bus which have more drawbacks that as reverse recovery problem and electromagnetic interference problem, when it is operated with extreme duty cycle. And controlled switch of these converters, suffer from high voltage spike and power loss due to leakage inductance of the transformers. To overcome these drawbacks we are introducing non -isolated buck boost converter based on ZETA converter.

# DC AND AC ACTIVE POWER FILTERS FOR DISTRIBUTED PHOTO VOLTAIC GRID SYSTEM

*A major project (Stage-II) report submitted in partial fulfillment of the requirements for the award of the degree of*

**BACHELOR OF TECHNOLOGY**

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# ABSTRACT

Decentralized and Distributed Generation of solar power is one of the fastest growing models of power generation across the world. Harmonics are generated because of the presence of non-linear and small industrial type loads connected to these sources. This work presents active DC and AC power filters to reduce the harmonics of the same. The design aspects, modelling and simulation of the filters have been performed. The entire system consisting of solar power generating array, DC loads, 3 phase inverter and the AC loads have been modelled to review the performance of the filter in the presence of the variable loads. The DC filter is an active filter that is controlled by a PI controller to stabilize the DC voltage. The AC filter is a three phase PWM rectifier based filter where the switching is controlled based on the generated current reference

# CHAPTER 5
# CONCLUSION

In this work, step by step modelling of the entire distributed generation and the modelling of the loads with non-linear behaviour has been described. The simulation and performance analysis of DC and AC active power filters has been found to be very satisfactory. The DC ripple voltage has been found to be reduced by 17.7%. It does not only reduce the ripple voltage but also stabilizes the DC line voltage and current. This shows that the active control using PI is advantageous compared to the conventional passive filters. Further more, The performance of the shunt active power filter is unquestionable. Owing to the employment of the hysteresis control loop, the AC filter reduced the THDi to 19.59%. This distributed generator system can be used for powering remote areas and helps in powering small scale industrial loads. The above modelling technique serves as a reference for the design for the industry helping in effective implementation with intelligent decision making.

# IR SENSOR BASED POWER SAVER FOR AUDITORIUM AND CONFERENCE HALL

**A Mini Project Report**

Submitted in partial fulfillment of the

Requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

**In**

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# ABSTRACT

The design and development of a smart monitoring and controlling system for household electrical appliances in real time has been reported. The system principally monitors electrical parameters of household appliances such as voltage and current and subsequently calculates the power consumed. The novelty of this system is the implementation of the controlling mechanism of appliances in different ways. The developed system is a low-cost and flexible in operation and thus can save electricity expense of the consumers. The prototype has been extensively tested in real-life situations and experimental results are very encouraging. Task scheduling on single or multiple processing elements is considered as one of the most common methods to achieve lower power consumption.

The Automatic power saving system for a home/office/shopping mall with security system is a method for automatic control of devices (lights, fans, or AC s) throughout home or in a shopping mall. A unique architecture of occupancy sensors includes entry/exit sensors for detecting movement through doorways that separate rooms in the home, room motion sensors for detecting room occupancy, spot sensors to detect occupancy of specific locations within the rooms. A central embedded controller communicates with the sensors and controlled objects over a communication network, where the sensors and controlled objects can be added to the system in a 'plug and play' manner. According to the proposed system, the number of visitors entering into and exiting from the Auditorium is calculated and is displayed. Apart from this, the appliances are made ON and OFF according to the number of persons present in the shopping mall by which power can be utilized with great efficiency and also implemented with security provision by which if unauthorized person enter to room means the dc siren gives alarm sound.

# CONCLUSION

The project "IR sensor based power saver for auditorium and conference hall" has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

# FUTURE SCOPE

In the future, simulating this system there are several improvements can be made in order to upgrade the features such as---

- Using a wireless technology to interface sensor and microcontroller, monitor and control the temperature via internet.
- When temperature exceeds the limit, a call will be dialed to the given number by an automatic dialed system.
- With this circuit, an alarm circuit can be added and used effectively in large equipment's where the risk of being overheated and explosions are the serious problems in various industries.

# Control of Photovoltaic Inverters for Transient and Voltage Stability Enhancement

A Major Project (Stage-I) Report submitted in partial fulfillment of the

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# ABSTRACT

The increasing number of megawatt-scale photovoltaic (PV) power plants and other 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 PV inverter'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.

# CONCLUSION

There are many drawbacks associated with the use of a DC microgrid in the current market, however most of these problems can be overcome as these systems become more familiar to contractors and designers. As familiarity is achieved, the system cost should continue to decrease leading to even more familiarity and so on. As with all new technologies it takes time to be adopted and the full potential of the system to be utilized.

In this work, a control scheme for PV inverters is proposed to act during faults that could compromise the transient and voltage stability of a hybrid power system. The analysis demonstrated that the proposed control scheme can act while the PV system is in MC operation, supporting the grid to recover stability during and after a disturbance on the transmission grid. The proposed control scheme makes the SM kinetic energy to be absorbed into the dc link capacitors to ensure transient stability. Besides that, it also enables the injection of reactive power into the grid to support voltage stability.

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.

# A NOVEL HIGH-GAIN DC-DC CONVERTER APPLIED IN FUEL CELL VEHICLES

A Major Project (Stage-I) Report submitted in partial fulfillment of the Requirements for the award of the degree of

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# ABSTRACT

The DC-DC converter for fuel cell vehicles should be characterized by high-gain, low voltage stress, small size and high-efficiency. However, conventional two-level, three-level and cascaded boost converters cannot meet the requirements. A new non-isolated DC-DC converter with switched-capacitor and switched-inductor is proposed in this paper, which can obtain high-gain, wide input voltage range, low voltage stresses across components and common ground structure. In this paper, the operating principle, component parameters design, and comparisons with other high-gain converters are analyzed. Moreover, the state-space averaging method and small-signal modeling method are adopted to obtain the dynamic model of converter. Finally, simulation and experimental results verify the effectiveness of the proposed topology. The input voltage of the experimental prototype ranges from 25V to 80V. The rated output voltage is 200V and rated power is 100W. The maximum efficiency is 93.1% under rated state. The proposed converter is suitable for fuel cell vehicles.

# CONCLUSION

This project presents a non-isolated DC-DC converter topology for fuel cell vehicles. The proposed converter can obtain high-gain and wide input voltage range. The voltage gain can reach $2(1-d)/(1-2d)$ and duty cycle $d<0.5$ while achieving high-gain. The voltage stresses across components are less than half of the output voltage, which is beneficial to reduce the size and cost of the converter. In addition, the circuit topology is a common ground structure, which can avoid EMI and safety problems. The converter can always maintain the stability of the output voltage by closed-loop control. There are not the voltage overshoot and impulse current during soft-start process by adopting the soft-start program. Under the rated state, the measured maximum efficiency of the prototype is 93.1%. The proposed converter is suitable for fuel cell vehicles.

# GRID-CONNECTED WIND-SOLAR COGENERATION USING BACK-TO-BACK VOLTAGE-SOURCE CONVERTERS

Major Project (Stage-I) Report Submitted in partial fulfillment of the requirements for the award of the degree of

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# ABSTRACT

This project introduces a new topology, yet simple and efficient, for a grid-connected wind-solar cogeneration system. A permanent magnet synchronous generator-based full-scale wind turbine is interconnected to the utility grid. The dc-link capacitor has been utilized to directly interface a photovoltaic solar generator. No dc/dc conversion stages are required, and hence, the hybrid system is simple and efficient. Moreover, the proposed topology features an independent maximum power point tracking for both the wind and the solar generators to maximize the extraction of renewable energy. Moreover, the proposed topology features an independent maximum power point tracking for both the wind and the solar generators to maximize the extraction of the renewable energy. The regulation of the VSCs is achieved via the vector control in the rotating reference frame. The detailed small-signal models for the system components are developed to characterize the overall stability. The influence of the utility-grid faults on the performance of the proposed system is also investigated. Nonlinear time-domain simulation results under different operating conditions are presented to validate the effectiveness of the proposed topology. The approach of linearly decreasing scheme for weighting factor and cognitive and social parameter is modified. The proposed control scheme can overcome deficiency and accelerate convergence of the IPSO-based MPPT algorithm. The detailed small-signal models for the system components are developed to characterize the overall stability. The influence of the utility-grid faults on the performance of the proposed system is also investigated. Nonlinear time-domain simulation results under different operating conditions are presented to validate the effectiveness.

# CONCLUSION

This project has presented the combination of the wind and solar systems using vector-controlled grid-connected back-to-back VSCs. The VSR at the wind generator side is responsible for extracting the maximum wind power following the wind velocity variations. On the utility-grid side, the roles of the VSI are to extract the maximum PV power from the PV generator, achieve the balance between the input and output powers across the dc-link capacitor, and to maintain a unity PCC voltage under different modes of operation. A small-signal linearization analysis has been conducted where the entire state-space model is developed to investigate the system stability. The proposed system features the following advantages: 1) The increased reliability and efficiency due to the combined wind and solar generators. 2) The independent MPPT extraction as the VSR and VSI are solely responsible for extracting the wind and PV powers, respectively. 3) The regulation of the dc-link voltage under all operating conditions is maintained by the VSI and hence a better damped performance is yielded. 4) Simple system structure and controller design. 5) Fault-ride through can be achieved using existing protection schemes. A well-damped performance and an efficient operation have been revealed from the time-domain simulations results under the MATLAB/Simulink environment under different operational scenarios.

# IMPLEMENTATION ON PF IMPROVEMENT OF BRUSHLESS DC MOTOR DRIVES USING ZETA CONVERTER

A

**Major Project Stage-2 Report-**

Submitted in partial fulfillment of the
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# ABSTRACT

Study manages a shriveled sensing element arrangement of an influence issue revision (PFC) primarily based letter of the alphabet device for brushless DC (BLDC) engine drive for low power applications. The speed of the BLDC engine is unnatural by differing the D.C. -user interface voltage of the voltage supplying electrical converter (VSI) sustaining the BLDC engine movement. A low recurrence exchanging of the VSI is employed for accomplishing the electronic substitution of the BLDC engine for diminished exchanging misfortunes. The greenhouse emission-based letter of the alphabet device is meant to figure in broken electrical device current mode; during this method employing a voltage adherent methodology which needs a solitary voltage sensing element for dc-connect voltage management and PFC activity. The planned drive is meant to figure over a large scope of speed management with improved power quality at air-con mains.

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# CONCLUSIONS

A greenhouse emission alphabetic character convertor nourished BLDC engine drive has been planned for a good scope of speed management with UPF at air-con mains. The speed of BLDC engine has been affected by differing the dc-interface voltage of VSI through the greenhouse emission alphabetic character converter. The greenhouse emission alphabetic character converter has been supposed to figure in DICM, that needed a voltage follower for dc connect voltage management. A solitary voltage detector has been needed for the whole drive, which makes it a sensible arrangement. Additionally, low-recurrence exchanging beats are used for electronically commutating the BLDC engine that offers diminished exchanging misfortunes within the VSI contrasted and standard arranges of PWM-based exchanging of VSI. The intense problems with this drive r the voltage & current weights on the nursery emission converter transposition, which restricts its activity for low power applications program. Decrease of those burdens utilizing delicate exchanging procedures must be compelled to be accomplished for raising the operating force run. Additionally, a decrease of Hall-Effect position detector is used utilizing the detector less management of BLDC engine drives for utilization of those drives in unsafe conditions.

# ZSI supported DSTATCOM for Plug-in Electrical Vehicle charging station

A

**Major project (Stage-I) 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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# VAAGESWARI COLLEGE OF ENGINEERING

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**CERTIFICATE**

Certified that this bonafide record of the major project (stage-I) entitled "ZSI supported DSTATCOM for Plug-in Electrical Vehicle charging station", Submitted by the following student to the department of Electrical & Electronics Engineering, in partial fulfilment of the requirements for the award of the Degree of **BACHELOR OF TECHNOLOGY**, and is a bonafied record of the work performed by

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# ABSTRACT

In this research work, bidirectional Z Source Inverter (ZSI) supported DSTATCOM is utilized for Plug-in Electric vehicle (PEV) charging station. The PEV are being replaced by the conventional vehicles to reduce atmospheric pollution and reduce fuel consumption. A ZSI supported DSTATCOM is presented in this research work to improving the power quality of a power system and PEV charging station by using the Instantaneous Symmetrical Component Theory (ISCT) control technique. This system is presented for decreasing harmonics on the supply signals and elimination of large currents in the system due to a fault in the power system and PEV charging station. ZSI acts as a multi converter and has a feature of buck/boost. The power quality aspects are governed by the various standards such as the IEEE-519-1992 standard. The results are extracted using extensive digital simulations performed in MATLAB/SIMULINK environment.

# CONCLUSION

This research paper has presented Z-Source network supported DSTATCOM for PEV charging station's-source dc-dc converter generates reverse power flow. Effect of Harmonics and large currents occurs in the source side because of faults in power system and PEV charging stations. It reduces and eliminated by using the ISCT control technique and HCC. The ZSI supported topology is performance well under balanced and unbalanced conditions compare to balanced VSC DSTATCOM. The supply is found nearly adjusted balance and THD of the supply current fulfilling the IEEE-519-1992 standard guidelines on as far as harmonic limit.

# PV BASED SHUNT ACTIVE HARMONIC FILTER FOR POWER QUALITY IMPROVEMENT

A Major project (Stage-I) 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

This article explores the performance analysis of two stage solar photovoltaic (PV) systems integrated with Shunt Active Harmonic Filter (SAHF). In recent industrial revolution, the distributed power system is affected by current harmonic problem due to wide-spread use of non linear loads. The SAHF system provides harmonic mitigation, power factor correction, and load compensation. The SAHF system is constructed with three-leg Voltage Source Converter and DC power extracted from the PV module. In this double stage system the first stage is a DC-DC step up converter which is implemented with maximum power point tracking (MPPT) algorithm. For extracting the maximum power P&O algorithm is used. The extraction of reference current is derived by PI controller and Hysteresis Current controller is used to drive the PWM -VSI. The projected PV based SAHF is implemented under diode rectifier load to mitigate the harmonics and reactive power.

# CONCLUSION

The performance of shunt active harmonic filter system powered by PV array system is analyzed.A P&O based MPPT technique which is faster as being the domain approach has been successfully implemented with Boost converter.The SAHF is implemented with PWM-VSI controller. . An adaptive hysteresis controller is implemented to produce the switching pulse for PWM-VSI. For reference current extraction PI controller is used. PI control method has been utilized to control the reference current by controlling the dc voltage obtained from PV array system.From simulation of without SAHF,we obsereved that the current harmonic components phase shifted to 180 degrees.It can be seen that the source current becomes sinusoidal thus becoming free of electrons.

# WIRELESS POWER TRANSFER TO ELECTRIC VEHICLES ALONG WITH REGENERATIVE BRAKING USING BATTERY-SUPERCAPACITOR COMBINATION

*A major project (Stage-1) report submitted in partial fulfillment of the requirements for the award of the degree of*

**BACHELOR OF TECHNOLOGY**

*in*

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# ABSTRACT

Wireless power transfer (WPT) has gotten a lot of attention in the present times and is going to become our potential future. From small power application scenarios such as charging a mobile phone to high power scenarios like charging an electric vehicle (EV), WPT is investigated as an option. The growing market share of electric vehicles raises questions whether it is possible to integrate wireless charging technology developed for low power applications into this high-power application. Furthermore, it should be investigated if the integration of regenerative braking into the overall system is possible. Several converters have been proposed to enable regenerative braking (RB). However, there is a lack of studies examining the interaction of both technologies on the system level. This project proposes the integration of an inductive wireless power transfer (IWPT) system and a regenerative braking system into an EV. The merits of the proposed system are represented in scenarios where a considerable amount of power is lost due to frequent acceleration and deceleration. This project describes the study of the system level integration of a regenerative braking system and a WPT system into an EV. It presents the design, development, and simulation of the complete system along with the brushless direct current (BLDC) traction motor. It shows the simulation model of the Inductive wireless power transfer system (two stage) to EV and acceleration/ deceleration phenomenon of BLDC motor. The speed and torque parameters of BLDC motor are the externally controlling variables of EV, having battery-supercapacitor (battery-SC) as storage devices during this transition period. Regenerative braking in BLDC motor can be observed when EV is under sudden deceleration motions consuming/producing excessive current where SC picks up the transients in place of the battery.

# CHAPTER 6
# CONCLUSION AND FUTURE SCOPE

This system is modelled and the operation of the WPT to electric vehicles along with regenerative braking using battery-supercapacitor combination is presented along with working of different components, which are used to propose this project. In comparison to other similar types of the regenerative braking schemes, the proposed method allows supercapacitor to react to transients and battery to react slowly. The battery lifetime can be improved by incorporating SC in the system. Thus, it can be concluded that the presented scheme can recover the braking energy and store it in the SC and battery, enabling efficient operation of the HESS. The proposed system can be converted into a dynamic WPT system with simultaneous power transfer capabilities. Providing flexibility to the system via making it dynamic and improving the compensation topology would be more beneficial and helps in saving lifetime of battery in EVs.

An implementation of this model can be done in stage 2 of this project which provides the circuit design in MATLAB and simulation studies along with the regenerative braking system which includes WPT, proposed system, working of BLDC motor and control structure of the proposed system.

# Construction and performance Investigation of Three-Phase Solar PV and Battery Energy Storage Systems Integrated UPQC

A Major Project (Stage-I) 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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This is certify to that the Major project (stage-I) 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) in this work. Generally, the grid supplies the active power to the load. However, if the grid is unable to supply the power then the photovoltaic (PV) activates and provides power especially during the longer-term voltage interruption. Therefore, Photovoltaic will improve the voltage support capability continuously in the longer-term, and keep producing clean energy. The phase synchronization operation of the UPQC controller is directed by a synchronous reference frame integrated with phase-locked loop. Thus, the phase-locked loop (PLL) is used to produce the synchronization phases for the series and shunt active power filter (APF) compensator in UPQC controller. Several case studies are further considered to validate the study in MATLAB-Simulink software.

# CONCLUSION

The construction of three-phase PV-UPQC has been investigated considering the condition of complex power quality problems which are an amalgamation of harmonics, voltage swell, and sags under unbalanced and distorted voltage grid condition. This Pv-UPQC system is having a large scale of power interruptions and less reliability. However the PV integration is still considering as a minor portion of power source for supplying the power to the load because it works only for 12 hours, that means in daytime. As for the higher power demand of non-linear loads during daytime, the power generated by PV optimizes power consumption at peak loads with its adequate daytime generation.

The PV-UPQC system is less stable because of the power generation capacity of Photovoltaic. So further stability PV-BESS-UPQC system is designed. So that the PV generated electricity will be stored in the BESS and also when PV is unable to supply the power to the load the BESS activates and supplies the power to the load, so that continuously the power is supplied to the load in peak times.

# DESIGN OF ULTRA-FAST ELECTRIC VEHICLE BATTERY CHARGER

A

**Major project (Stage II) report**

Submitted in partial fulfillment of

The requirements for the award of the degree of

**BACHELOR OF TECHNOLOGY**

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# ABSTRACT

As the world move towards using Electric Vehicles (EVs) as a sustainable way of commuting, 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 project, the performance of a 2KW Cuk converter operating in Continuous Conduction Mode (CCM) is assessed for Ultra-Fast Charging (UFC) of low voltage EV batteries such as the one used in golf carts. The designs were simulated and verified using MATLAB/Simulink, and the results show that the size and the complexity of the controller can be verified when the Cuk converter operates in CCM, meeting the requirements of international standards.

# REDUCTION OF HARMONICS USING PQ BASED HYSTERESIS CONTROLLED ACTIVE FILTERS

A Major project (Stage –II) report submitted in partial fulfillment

of the requirements of the degree of

**BACHELOR OF TECHNOLOGY**

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# ABSTRACT

A Three-phase Inverter-based Active Filter (Af) Zero Se Controlled By Instantaneous Real And Reactive Power Theory (Pq Theory) Based Hysteresis And Pi Controllers Are Presented In This Paper. An Inverter Based Af Is Used To Reduce The Harmonics Caused By Non-linear Loads In The Source Voltage And Current By Injecting The Compensating Currents. The Hysteresis Controller Generates The Gate Pulses Required For The Operation Of Af. Instantaneous Real And Reactive Power Theory (Pq Theory) Monitors The Active And Reactive Powers And Generates The Reference Current Accordingly. Pi Controller Regulates The Voltage Generates Of The Dc Link Capacitor. The Matlab Simulink Model Has Been Designed For The Proposed Approach And The Thd Is Reduced Significantly

# CONCLUSION

A current compensation technique based on instantaneous power theory and dc link hysteresis current control technique had been studied for shunt active power filters, a Simulink model is designed and total harmonic distortion is calculated using FFT analysis. Active power filter which has been used here monitors the load current constantly and continuously adapt to the changes in load harmonics. The theory is very efficient and flexible in designing controllers for power conditioner based on power electronics devices. It turns the instantaneous three-phase power that source delivers to load into a constant value (the source only delivers conventional active power).So overall THD has been reduced using this technique.

# A Major Project Report On

# A T-CONNECTED TRANSFORMER AND THREE-LEG VSC BASED DSTATCOM FOR POWER QUALITY IMPROVEMENT

A Major Project report submitted in partial fulfillment of the requirements for the award of the degree of

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# CONTROL AND ENEGRY MANAGEMANET OF A LARGE-SCALE GRID-CONNECTED PV SYSTEM FOR POWER QUALITY IMPROVEMENT

**A Major Project (stage II) report**

submitted in partial fulfillment of the requirement for the award of the degree of

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# ABSTRACT

Power quality is highlighted as an important parameter in modern power systems. Moreover, grid-connected photovoltaic power plants are increasing significantly in size and capacity. Elsewhere, due to the progressive integration of nonlinear loads in the grid, the principal role of a Solar Energy Conversion System (SECS) is not only to capture the maximum power from solar but, also to ensure some ancillary services and improve the quality of power. This project presents a novel strategy dedicated to improve the management of active power generation, reactive power compensation and power quality of a SECS, while guaranteeing the possibility of exploiting the full capacity of the Power Conditioning System (PCS) and the Photovoltaic System (PVS). The proposed control algorithm is applied to a large scale PVS connected to the grid through a cascade of a DC-DC converter and a PWM inverter.

This control strategy manages the SECS function's priorities, between main active power generation, reactive power compensation and active filtering in such a way to guarantee a smooth and stable DC voltage and ensure a sinusoidal grid current. Top priority is given to the active power production over power quality improvement. Then, priority is given to reactive power compensation over mitigation of current harmonics absorbed by the non-linear load connected to the Point of Common Coupling (PCC). Moreover, the whole system upper limits of active and reactive powers have been determined in the (PQ) power plane on the basis of PVS available power, converters rated power and DC bus voltage smoothness and stability.

Finally, a control procedure dedicated to the calculation of the inverter current commands is proposed in order to exploit the full capacity of the SECS and respect the determined power limits. Simulation results confirm the effectiveness and the performance of this control strategy and prove that the SECS can operate at its full power whilst the power quality can be improved by reactive power compensation and active filtering.

# CONCLUSION

In this project, a novel strategy has been proposed to manage and improve the power quality of a grid connected large scale PVS. More accurately, fuzzy logic controllers have been used to guarantee a decoupled control of active and reactive powers injected into the grid. The PWM inverter is controlled in such a way to manage between active power production and power quality improvement without exceeding the whole system power capacity. The proposed priority control block gives top priority to active power production, then reactive power compensation and finally active filtering. The power capability of the whole system has been delimited in the (PQ) power plane (on the basis of the PVS available power, the power electronics converters rated power and the DC bus voltage smoothness and stability) and exploited without over-rating, by the calculation of an appropriate portion of current commands in order to ensure a better active filtering quality and keep the inverter current under its limit value corresponding to the whole system power capacity. Simulation results show the effectiveness and the performance of the proposed approach in terms of power generation, reactive power compensation and active filtering.

# Implementation of Solar Photovoltaic System with Universal Active Filtering Capability

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 AND ELECTRONICS ENGINEERING

## CERTIFICATE

Certified that this bonafide record of the major project (stage-I) entitled "**IMPLEMENTATION OF SOLAR PHOTOVOLTAIC SYSTEN WITH UNIVERSAL ACTIVE FILTERING CAPABILITY**". Submitted by the following student to the department of Electrical & Electronics Engineering, in partial fulfilment of the requirements for the award of the Degree of **BACHELOR OF TECHNOLOGY**, and is a bonafied record of the work performed by

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The work embodied in this major project (stage-I) report has not been submitted to any other institution for the award of any degree.

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# ABSTRACT

In this work, a novel technique based on second order sequence filter and proportional resonant controller is pro- posed for control of universal active power filter integrated with PV array system (UAPF-PV). Using a second order sequence filter and sampling it at zero crossing of instant of the load voltage, the active component of distorted load current is estimated which is further used to generate reference signal for shunt active filter. The proposed method has good accuracy in extracting fundamental active component of distorted and unbalanced load currents with reduced mathematical computations. Along with power quality improvement, the system also generates clean energy through the PV array system integrated to its DC-bus. The UAPF-PV system integrates benefits of power quality improvement and distributed generation. The system performance is experimentally evaluated on an experimental prototype in the laboratory under a variety of disturbance conditions such as PCC voltage fall/rise, load unbalancing and variation in solar irradiation.

# CHAPTER-7
# CONCLUSION

The performance of a novel control technique for solar PV system with universal active filtering has been evaluated. The fundamental positive sequence component of nonlinear load current is extracted using a second order sequence filter along with a zero cross detection technique. The series active filter is controlled using a proportional resonant controller implemented in domain along with feedforward component. The system performs satisfactorily under disturbances such as PCC voltage dip/rise, changes in solar radiation and load disturbances. Apart from improving power quality, the system also supplies power from PV array into grid. A comparison of the proposed control shows that the system has improved performance as compared to conventional control techniques with slightly lower computational burden. The system integrates distributed generation along with enhancing power quality of distribution system.

# POWER QUALITY IMPROVEMENT OF GRID CONNECTED PHOTO VOLTAIC SYSTEMS USING TRANS-Z SOURCE INVERTER UNDER PARTIAL SHADING CONDITION

A Major Project (Stage-II) 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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# VAAGESWARI COLLEGE OF ENGINEERING

Department of Electrical and Electronics Engineering

## CERTIFICATE

This is certify to that the Major project (stage-I) report entitled **"POWER QUALITY OF IMPROVEMENT OF GRID CONNECTED PHOTO VOLTAIC SYSTEMS USING TRANS-Z SOURCE INVERTER UNDER PARTIAL SHADING CONDITION"** 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

Voltage-source inverter has been used widely in traditional photovoltaic systems which have limitations. To overcome, Z-source inverte has been introduced. Inspite of all the features introduced in Z-source inverter,its configuration has been improved over the years, like trans-Z-source inverter which has added vantages compared to traditional inverters, namely buck–boost feature, lesser passive elements, and higher voltage boost gain. In this paper, photovoltaic arrays are connected to the grid via the trans-Z-source inverter with the aim of improving its power quality. Moreover, the shoot-through duty ratio is kept constant in the switching control method to add features like lower voltage stress (higher reliability), lower total harmonic distortion (lower maintenance cost), and higher voltage boost ratio. To evaluate the precision of the proposed system, the photovoltaic system is simulated on a standard grid and under partial shading condition which brings about voltage sag, and hence, a dynamic voltage restorer is used to mitigate voltage sag. Simulation results are presented to verify the validation of the proposed photovoltaic system in terms of voltage and current THDreducing78.2%and19.7%,respectively.


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## CONCLUSION

In this paper, a PV system is connected to the IEEE 15-bus test network via trans-ZSI with the aim of power quality improvement, plus MCBC control is used to decrease voltage and current THD, and more importantly, to reduce voltage stress across the switches. The results indicate that applying the trans-ZSI and an appropriate switching method improve the power quality of the PV system to a considerable extent. Besides, the cost, volume, and weightof this inverter are low because of having no low-frequency ripples of the output voltage. What is more, as the shoot through does not damage the inverter, the reliability of the inverter is higher. In turn, not only is the reliability of this inverter higher, but also its maintenance cost is lower. The proposed PV system is also studied under partial shading conditions to validate its performance when there are some voltage sags. So, a DVR is employed to detect voltage sags and then mitigate them once partial shading happens. Two conclusions can be drawn from cases C and D: The voltage amplitude is roughly fallen back to its rated value, and the voltage THD is reduced when trans-ZSI is used. To summarize, the results illustrate that the PV system operates accurately with the trans-ZSI, as opposed to the PV systems with traditional VSI.

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