SRI VENKATESWARA
COLLEGE OF ENGINEERING AND TECHNOLOGY

Thirupachur-631203, Tiruvallur TK & DT

Approved by AICTE New Delhi & Affiliated to Anna University, Chennai

(A Telugu Minority Institution)

List of Students Under taking Project /Work for the Academic Year 2022-2023

Program Name: POWER ELECTRONICS AND DRIVE

PROJECT BATCH LIST 2022-2023

S.NO	REG NUMBER	STUDENT NAME	PROJECT TITLE	INTERNAL GUIDE
1	112421415002	DHANANCHEZHIYAN P	Smart grid power quality improvement using modified UPQC	Mrs.S.Geetha /AP/EEE
2	112421415003	ELAIYARASAN	Constant current fuzzy logic controller for grid connected EV charging	Mrs.S.Geetha /AP/EEE
3	112421415004	KAMESH S	Four quadrant operation and control of three phase brushless Dc motor for electric vehicles	Dr.M.Sivasubramanian ASP/EEE
4	112421415005	KUBENDARI V	Design and control of Autonomous wind solar system with DFIG Feeding 3-phase 4 wire loads	Mrs.S.Geetha /AP/EEE
5	112421415006	LAKSHMI N	An integrated Battery charger with high power density and efficiency for electrical vehicle	Dr.M.Sivasubramanian ASP/EEE
6	112421415007	MURALIDOSS S	Design and analysis of BI Directional DC-DC Driver for electric vehicles	Dr.M.Sivasubramanian ASP/EEE
7	112421415010	RAJAVENI M	Speed control of PV Array-Based Z-source inverter FED brushless DC motor using dynamic duty cycle control	Mrs.V.Supriya/AP/EEE
8	112421415011	RAMYA J C	Single phase multilevel converter based battery charger for low power EV charging	Mrs.S.Geetha /AP/EEE
9	112421415014	SANGEEETHA PRIYA R	Performance verification of full bridge DC-DC converter used for electric vehicles charging station	Mrs.V.Supriya/AP/EEE
10	112421415015	SARATH KUMAR E	Nature inspired Algorithms for energy management and charging station placement for e- vehicles	Dr.M.Sivasubramanian ASP/EEE
11	112421415016	SATHISH M	A new hybrid DC-DC converter	Mrs.S.Geetha /AP/EEE
12	112421415017	SWETHA A	Modeling of Dual active bridge converter for Application in EVs charging station	Dr.M.Sivasubramanian ASP/EEE
13	112421415018	VIJAYAKUMAR V	electric vehicles charging station eighth an energy storage stage for split DC bus voltage balancing	Mrs.V.Supriya/AP/EEE

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SMART GRID POWER QUALITY IMPROVEMENT USING MODIFIED UPQC

A THESIS

PROJECT WORK- II

Submitted by

DHANANCHEZHIYAN. P

112421415002

In partial fulfillment of the requirements for the award of the degree

Of

MASTER OF ENGINEERING

IN

POWER ELECTRONICS AND DRIVES

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

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OCTOBER -2023

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BONAFIDE CERTIFICATE

Certified that this project report titled "**SMART GRID POWER QUALITY IMPROVEMENT USING MODIFIED UPQC**"is the bonafide work of Mr. **DHANANCHEZHIYAN.P(112421415002)** who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

9/10/23

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Signature of the Supervisor with date

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ACKNOWLEDGEMENT

My wholehearted and sincere thanks to the "ALMIGHTY" for enabling me to do my research successfully.

First and foremost, I express my hearty sincerity to our chairman **Dr.S.K. PURUSOTHAMAN M.E, Phd.,** and our Principal **Dr.S.PALANI M.E, Phd.,** for providing their appreciation and facilities which made the experience a pleasant one.

I would like to express my sincere thanks to Supervisor, **Dr. M. SIVASUBRAMANIAN M.E, Phd.,** Vice Principal & Associate Professor at, the Department of Electrical and Electronics Engineering for his Continues encouragement. Constructive and precise comments on my research work. His intellectual inquiry, friendly approach, and sustained encouragement catalysed the progress of the research work.

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ABSTRACT

The Smart Grid system typically deals with different issues involving security and Power Quality (PQ) improvement. With massive usage of power electronic devices and growth of nonlinear loads, harmonics are inserted into the system. So, it is important to maintain the quality of the power for the efficient functioning of the end user equipment. The well-known Flexible AC Transmission System (FACTS) devices like Unified Power Quality Conditioners (UPQC) are usually employed to resolve the issues related to voltage sag, swell, flicker, PQ, and neutral current reduction of distribution systems. UPQC is a custom powered device which is considered as the grouping of DVR and D-STATCOM which performs series, shunt compensating and phase shifting at the same time. An UPQC itself inserts harmonics into the system that affects the system stability for sensitive loads. This paper describes biogeography based optimization (BBO) with harmonics elimination techniques for modified UPQC connected with Smart Grid. At fault condition UPQC mitigate the fault with simultaneous or individual operation of series-shunt converters. The excitation of Modified UPQC converters with DC link capacitor are obtained from PV (Photo-Voltaic) panel.

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CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION:

A noticeable trend in distribution systems is the emergence of distributed harmonic producing loads. These loads typically have comparable sizes and are distributed all over an electric network. There is a need to develop new techniques to assess harmonic distortions for systems with distributred harmonic sources. The objective of the project is to minimize the power quality problems with the implementation of power quality enhancement device pv UPQC. This device has the capacity to improve the power quality at the point of installation. Without pv UPQC the system voltage and currents are unbalanced undar fault condition with THD of 6.02%. When we applied pv UPQC with PI controller the output voltage is balanced and still some distortions observed in current waveforms under fault conditions the THD is reduced to 2.74%. By using the proposed Hybrid controller with pv UPQC the system output voltage and currents are balanced without any distortion and the THD is reduced finally to 0.08%. Hence the analysis proves that the proposed Hybrid controller with UPQC achieved better results when compared to the existing models.

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CONSTANT CURRENT FUZZY LOGIC CONTROLLER FOR GRID CONNECTED ELECTRIC VEHICLE CHARGING

A THESIS

PROJECT WORK- II

Submitted by

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In partial fulfillment of the requirements for the award of the degree

Of

MASTER OF ENGINEERING

IN

POWER ELECTRONICS AND DRIVES

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Certified that this project report titled "CONSTANT CURRENT FUZZY LOGIC CONTROLLER FOR GRID CONNECTED ELECTRIC BVEHICLE CHARGING "is the bonafide work of Mr.ELAIYARASAN.E **(112421415003)** who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form p... of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ACKNOWLEDGEMENT

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ELAI

ABSTRACT

The increase in demand for clean sources of energy is getting more attention in recent time. Electric vehicle (EV) is an important area to fulfil this demand. However, one of the major obstacles in the growth of EV is the longer charging time. Therefore, there is a definite need for the reduction of charging time in EVs. Constant current charging of EV can help to solve this problem. That's why, the role of DC-DC converter is very important. DC-DC converters are commonly utilized in electronic devices such as mobile phones, computers etc. This paper presents the possibility of grid connected constant current charging of EV with buck DC-DC converter through fuzzy logic control (FLC). FLC is easy to implement without the requirement of intensive mathematical modelling. The complete model of the considered system has been developed in MATLAB/Simulink. The achieved simulation results show the viability and capability of the proposed scheme. Keywords— DC-DC converter, fuzzy logic controller, electric vehicle.

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CHAPTER 8

CONCLUSION

In this project, the complete model of EV charging system with the utilization of fuzzy logic controller is presented. The complete simulation model has been developed in MATLAB /Simulink. The achieved simulation results show how easy FLC can be used in EV charging without the requirement for any tuning like with PI controller. In perspective of this work, experimental validation of the proposed scheme can be performed.

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FOUR QUADRANT OPERATION AND CONTROL OF THREE PHASE BRUSHLESS DC MOTOR FOR ELECTRIC VEHICLES

A THESIS

PHASE II

Submitted by

KAMESH S

112421415004

In partial fulfillment of the requirements for the award of the degree

Of

MASTER OF ENGINEERING

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Certified that this project report titled " **FOUR QUADRANT OPERATION AND CONTROL OF THREE PHASE BRUSHLESS DC MOTOR FOR ELECTRIC VEHICLES** " is the bonafide work of **Mr. KAMESH . S (112421415004)** who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ACKNOWLEDGEMENT

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KAMESH. S

ABSTRACT

This project presents the control of Brushless direct current (BLDC) motor in all four quadrants (forward/reverse motoring/braking) with the help of the bidirectional DC-DC converter. The output of the DC-DC converter is fed to the three-phase voltage source inverter (VSI) to drive the motor. During the motoring mode buck operation through the bi-directional converter of the battery takes place and during regenerative mode, the mechanical energy is converted into electrical energy and is stored in the same chargeable battery through the boost operation. As the electric vehicle operates with frequent start/stop, the scheme proposes recovery of energy for every stopping operation through regenerative braking. Also when the electric vehicle (EV) is going on a downhill, the controlled speed on downhill provides energy return to the battery. MATLAB/Simulink software is used to verify the above operations.

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CHAPTER 6

CONCLUSION

The four quadrant operation is simulated for the electric drive with maximum efficiency keeping in mind the fuel constraint. The battery is charged during the regenerative mode and the speed control using the closed loop control is performed. The proposed method requires the minimum hardware and the operation can be controlled in all the four quadrants. During the regenerative mode, the kinetic energy is returned via the bi-directional converter to charge the battery. The abovementioned proposal could be applied in electric vehicle downhill run by controlling the speeding in gravitational action where the speed becomes more than the reference speed. The practical implementation is under progress for the proposed method.

DESIGN AND CONTROL OF AUTONOMOUS WIND SOLAR SYSTEM WITH DFIG FEEDING 3-PHASE 4-WIRE LOADS

A THESIS

PHASE II

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In partial fulfillment of the requirementsfor the award of the degree Of

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ACKNOWLEDGEMENT

Protected by the omnipotent powers of the almighty, together with the blessings of our parents, their unconditional love, support and encouragement, success has kissed us in completing this project. It is our dignity to dedicate this project to them.

I express my hearty sincerity to our founder Chairman Dr.S.K. **PURUSOTHAMAN. Ph.D.,** and our Principal **Prof. Dr. S. PALANI,M.E.,Ph.D.,** for providing their appreciation and facilities which made the experience a pleasant one.

I express my profound gratitude to **Mrs.S. GEETHA, M.E.,** Head of the Department of Electrical and Electronics Engineering, for his timely suggestions concerning about this project.

It is a great pleasure to express my gratitude and thanks towards my Internal Guide as well Project Co-OrdinatorMr.**M.NAMACHIVAYAM,M.E.,** Supervisor andAssociate Professor for his uninterruptable suggestions and words of improvements regarding this project, which played a major role in guiding us in my track.

Sincerely, we thank all the faculty members and technical assistants of the Electrical and Electronics Engineering Department for their constant support, valuable suggestions, encouragement and guidance throughout the period of study, without which hitting this mark of success would have been a layman's dream.

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KUBENDRI.V

ABSTRACT

Power conversion systems for electric vehicles (EVs) have been researched to improve power density and efficiency at low cost. To satisfy theses need for EVs, this project proposes a novel battery charging system that integrates a non-isolated on-board charger (OBC) and low-voltage dc–dc converters (LDCs) by sharing the semiconductor devices and mechanical elements. Thus, the volume of LDCs is reduced dramatically compared with a conventional non-integrated charging system. The proposed integrated system is configured based on a driving condition that is derived from the analysis of vehicle operating modes. In order to improve system performance, an asynchronous control algorithm is applied to control the OBC optimally. In the LDC system, two LLC resonant converters are composed by sharing a transformer and secondary side components. To increase the efficiency of each LDC, which are operated in the wide input and output voltage range, a duty and frequency control algorithm is proposed.

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CHAPTER 9

CONCLUSION AND FUTURE SCOPE

9.1 CONCLUSION:

In this project, the design and implementation of an integrated power unit for EVs was presented in order to improve the power density and efficiency. An integrated charger structure to integrate the OBC and LDC was proposed by using a structural analysis of a cascaded buck-boost converter. The design method for the OBC and an asynchronous control algorithm to reduce the inductor current were proposed. The integration of the LDC, which shares the transformer and the second side, with a duty and frequency control to improve efficiency, was designed. The proposed integrated power unit minimizes both the number of power devices and the volume of the passive components. In addition, efficiency was improved by adapting novel control algorithms such as an asynchronous control algorithm for the OBC and a duty and frequency hybrid control algorithm for the LDC. High performance in charging the batteries was also achieved across a wide input and output voltage range. The proposed integrated power unit including control algorithm was verified by experiment under various operation conditions.

The OBC prototype achieves a peak efficiency value of 97.3% in boost operation mode and 97% in buck operation mode. The H-LDC achieves a peak efficiency of 93.1%, and the L-LDC achieves a peak efficiency of 92.2%. And, the total volume of the LDCs is 1.87L, which is 85% of the conventional LDC average volume, by maintaining the efficiency compared with other research. Therefore, the proposed integrated system could be used as an effective method for increasing power density of power conversion units for electric vehicles.

AN INTEGRATED BATTERY CHARGER WITH HIGH POWER DENSITY AND EFFICIENCY FOR ELECTRIC VEHICLES

A THESIS

PROJECT WORK- II

Submitted by

LAKSHMI. N

112421415006

In partial fulfillment of the requirements for the award of the degree

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BONAFIDE CERTIFICATE

Certified that this project report titled **"AN INTEGRATED BATTERY CHARGER WITH HIGH POWER DENSITY AND EFFICIENCY FOR ELECTRIC VEHICLES"** is the bonafide work of **Ms. LAKSHMI. N (112421415006)** who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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LAKSHMI. N

ABSTRACT

Power conversion systems for electric vehicles (EVs) have been researched to improve power density and efficiency at low cost. To satisfy theses need for EVs, this project proposes a novel battery charging system that integrates a non-isolated on-board charger (OBC) and low-voltage dc-dc converters (LDCs) by sharing the semiconductor devices and mechanical elements. Thus, the volume of LDCs is reduced dramatically compared with a conventional non-integrated charging system. The proposed integrated system is configured based on a driving condition that is derived from the analysis of vehicle operating modes. In order to improve system performance, an asynchronous control algorithm is applied to control the OBC optimally. In the LDC system, two LLC resonant converters are composed by sharing a transformer and secondary side components. To increase the efficiency of each LDC, which are operated in the wide input and output voltage range, a duty and frequency control algorithm is proposed.

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CHAPTER 9

CONCLUSION AND FUTURE SCOPE

9.1 CONCLUSION:

In this project, the design and implementation of an integrated power unit for EVs was presented in order to improve the power density and efficiency. An integrated charger structure to integrate the OBC and LDC was proposed by using a structural analysis of a cascaded buck-boost converter. The design method for the OBC and an asynchronous control algorithm to reduce the inductor current were proposed. The integration of the LDC, which shares the transformer and the second side, with a duty and frequency control to improve efficiency, was designed. The proposed integrated power unit minimizes both the number of power devices and the volume of the passive components. In addition, efficiency was improved by adapting novel control algorithms such as an asynchronous control algorithm for the OBC and a duty and frequency hybrid control algorithm for the LDC. High performance in charging the batteries was also achieved across a wide input and output voltage range. The proposed integrated power unit including control algorithm was verified by experiment under various operation conditions.

The OBC prototype achieves a peak efficiency value of 97.3% in boost operation mode and 97% in buck operation mode. The H-LDC achieves a peak efficiency of 93.1%, and the L-LDC achieves a peak efficiency of 92.2%. And, the total volume of the LDCs is 1.87L, which is 85% of the conventional LDC average volume, by maintaining the efficiency compared with other research. Therefore, the proposed integrated system could be used as an effective method for increasing power density of power conversion units for electric vehicles.

DESIGN AND ANALYSIS OF BI-DIRECTIONAL DC-DC DRIVER FOR ELECTRIC VEHICLE

A THESIS

PHASE II

Submitted by

MURALIDOSS. S

112421415007

In partial fulfillment of the requirements for the award of the degree Of

MASTER OF ENGINEERING

IN

POWER ELECTRONICS AND DRIVES

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SRI VENKATESWARA COLLEGE OF ENGINEERING AND TECHNOLOGY, THIRUPACHUR

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OCTOBER 2023

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BONAFIDE CERTIFICATE

Certified that this project report titled **"DESIGN AND ANALYSIS OF BI-DIRECTIONAL DC-DC DRIVER FOR ELECTRIC VEHICLE "** is the bonafide work of **Mr. MURALI DOSS. S (112421415007)** who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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Protected by the omnipotent powers of the almighty, together with the blessings of our parents, their unconditional love, support and encouragement, success has kissed us in completing this project. It is our dignity to dedicate this project to them.

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ABSTRACT

The level of exhaust gases is rising with increasing usage of internal combustion engine vehicles. In order to reduce carbon emission, researchers and industry head up for improving electric vehicle technologies in all over the word. This paper deals with design and simulation of a bi-directional power converter of electric vehicle. The power electronics block is comprised by batteries, bi-directional dc-dc converter and dc machine. The initial state of battery charge is set around 90% where the discharge current is 44.5 A during motor mode. The nominal voltage of battery stack is 350 V and maximum capacity is 100 Ah. The rated power of dc machine is set to 250 HP with 500 V armature voltage and 300 V field voltage. The operating mode of power converter is determined according to the torque values of dc machine which is operated in motor and generator modes. The charge and discharge conditions of batteries have been controlled regarding to operating modes of dc machine. The bi-directional dc-dc converter is controlled with fuzzy logic controller in both modes. The proposed converter and controller are designed to meet charge control and motor drive requirements of an all-electric vehicle.

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CHAPTER 9

CONCLUSION

This project presents design and control bi-directional dc-dc converter for all-electric vehicle. The bi-directional dc-dc converter is controlled with PI-C according to rules. When the battery is discharged, the dc machine is operated in motor mode and bi-directional dc-dc converter is operated in boost mode. Variable positive torque values are applied to the dc machine and condition of the battery is observed. According to simulation result, the battery SoC is reduced from %88 to %87.337 and voltage of the dc machine is constant at 500 V. When the battery is charged, the dc machine is operated generator mode and bi-directional dc-dc converter is operated in buck mode. Variable negative torque values are applied to the dc machine and effect on the battery is observed. According to simulation result, the battery SoC is increased from %87.337 to %87.445. In all-electric vehicle, regenerative breaking is occurred in this state. Charge and discharge states of the battery are the most essential for distance to determining.

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SPEED CONTROL OF PV ARRAY-BASED Z-SOURCE INVERTER FED BRUSHLESS DC MOTOR USING DYNAMIC DUTY CYCLE CONTROL

By

M.RAJAVENI

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A PROJECT REPORT (PHASE-II)

Submitted to the

FACULTY OF ELECTRICAL & ELECTRONICS ENGINEERING

In partial fulfillment of the requirements

for the award of the degree

of

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Certified that this project report titled "SPEED CONTROL OF PV ARRAY BASED Z-SOURCE INVERTER FED BRUSHLESS DC MOTOR USING DYNAMIC DUTY CYCLE CONTROL" is the bonafide work of Ms. M.RAJAVENI (Reg. 112421415010) who carried out the research work under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any othercandidate.

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First and foremost, I express my hearty sincerity to our chairman **Dr.S.K.PURUSOTHAMAN M.E., Ph.D.,** and our principal **Dr.S.PALANI M.E., Ph.D.,** for providing their appreciation and facilities which made the experience a pleasant one.

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ABSTRACT

The development of advanced motor drives are primarily concerned with efficiency and reliability. Traditional motor drive technology is used in residential and commercial appliances such as refrigeration and air conditioning systems. A brushless dc motor has the advantage that its efficiency is high and also maintenance required is very low. The speed of the BLDC motor has been controlled with shoot-through Zero states by shorting one arm of the same leg of an inverter. The Z-source inverter system has distinctive properties that it can decrease as well as increase voltage levels by using its shoot-through zero states which is not present in traditional inverters. Here a dynamic duty cycle control is proposed to control the BLDC motor speed utilizing shoot-through zero states of the Z-source inverter. For commutation purposes, hall sensor signals are used. The modelled has been analysed and simulated using MATLAB/SIMULINK and Experimental studies are carried out to verify the performance of the proposed method.

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CHAPTER 9

CONCLUSION

A new method has presented in this Project for controlling the speed of the BLDC motor with the help of a Z-Source inverter. The Z-source inverter used its Shoot-through zero state to achieve the BLDC motor to its reference speed by increasing the voltage level of the system. As reference speed changes its value, the shoot-through zero states duty cycle also changes to achieve the required speed. In an closed-loop system, we have to change the duty cycle manually for controlling the speed. The entire system (closed-loop), controlling method and operating principle is analyzed on MATLAB/SIMULINK software. Also we discuss this system has less switching loss as we shorted on earm only. This system is suitable where a high speed to torque ratio is required also stress and loss in switches are less because one leg is shorted for the shoot-through state.

FUTURE SCOPE:

1. The ripples in torque are found to be high so a reduction in torque-ripple can be studied further.
2. Back-Emf method can be employed with a Z-source inverter for speed control.

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