



MODEL PREDICTIVE CONTROLLER BASED HIGH GAIN DUAL INPUT SINGLE OUTPUT Z-QUASI RESONANT DC\DC CONVERTER FOR OFF-BOARD EV CHARGING

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ABSTRACT

This art work focuses on a multi-port model predictive controller grounded completely non-isolated (Binary enter and single output) DC/ DC power digital interface grounded on Z- Quasi Resonant (ZQR) community. The motor includes grid and photovoltaic panel (PV) as its input means. Unlike the primary DC/ DC converter, the supported DC/ DC motor calls for smaller switches and gives nonstop slice- edge-day, high benefit in voltage, and minimum voltage stress on motor transfer as lots as 40 obligation cycle thanks to the presence of ZQR community. This specific of the motor makes it to and its software program in electric powered auto (EV) off- board charging wherein inordinate voltage benefit is demanded. In the proposed multi-port ZQR motor, fresh input and affair anchorages could be added without compromising the motor's benefit and overall performance. The evolved motor can characteristic constantly despite the fact that someone of the input things fails to rate the EV. The proposed motor is mathematically modeled the operation of abecedarian felonious pointers that govern the motor average overall performance and anatomized in MATLAB/ Simulink platform underneath colorful operating modes.

Keywords: ZQR community, DC/ DC converters, MPC and LED lighting.

1. INTRODUCTION

The massive development in Internal Combustion Engine (diesel- grounded completely or petrol- primarily grounded vehicles) has delivered about rise in air pollution encyclopedically. To dock the emigration of CO₂, numerous nations have started in depth studies in the discipline of electrical vehicles. Besides the reduction of fossil energies, it's also a pivotal motive to choose special volition things of electricity for dicker. The Indian

authorities has set larger solicitations on the electrical buses the front. By 2030, India has deliberated to replace all 3- wheeler diesel/ petrol- grounded completely buses by means of electric buses and increase the income to 35 chances for machine motors, seventy-five chance for artificial vehicles, forty-five chance for public shipping, and 75 chance for auto- cabs and motorcycles. piecemeal from the power fed on for moving an auto, the strength from reactionary energy is also wasted as follows disunion that exists amongst tires and weight face. The power exhausted in dashing up the machine has defuncted as temperature. The necessity to deliver electricity for contrivance which incorporates LED lighting, hitting addict, air con, and electricity steering. A conventional ICE vehicle converts the energy from combustion into oils, which drives the entire auto. The temperature produced via the combustion machine and heat machines consume power in step with the performance circumscribe. likewise, it's far tough to increase the theoretical performance restriction because of the reality. Some temperature overhead push may also have defuncted over cylinder walls Burning of energy at further than the most capability pressure Energy is also wasted in the course of the retardation mode. Proliferation of petrol/ diesel motorcars reason environmental adulterants, transnational warming, fast upward thrust in gasoline freights, and rapid-fire reduction of fossil energies. thus, oil painting-grounded motors are converted currently into electric powered motors (EVs) through way of the automotive diligence. The advantages of electric motors over conventional ICE primarily grounded buses are as follows. The electric powered buses (EV) produce zero- emigration. They're terrain-nice and bring much lower noise. Another advantage of EVs is the decomposable batteries which can be connected in the electric powered buses, lower working charges, drop keep freights and silent trip.

2. LITERATURE SURVEY

1. LONGCHENG TAN; BIN WU; SEBASTIAN RIVERA; VENKATA YARAMASU, (2016). 'COMPREHENSIVE DC POWER BALANCE MANAGEMENT IN HIGH- POWER THREE- POSITION DC- DC CONVERTER FOR ELECTRIC VEHICLE FAST CHARGING'. IEEE DEALS ON POWER ELECTRONICS, VOL. 31, NO. 1, PP. 89- 100.

Proposed entire dc electricity balance operation (PBM) on the hand of inordinate- energy 3- degree dc- dc motor primarily grounded surely rapid-fire bowl. The energetic dc energy stability operation (APBM) is proposed to help the number one NPC motor in balancing electricity in order that the redundant balancing circuit is removed; on the same time because the unresistant dc electricity balance operation (PPBM) is proposed to dispose of the shifting unprejudiced- factor currents and to make sure the balanced operation of speedy dishes. The conditions of APBM and PPBM are delved, the effective integration between them is studied, and the overall manipulate scheme for the short bowl is proposed. The electricity balance limits of APBM are explored, whilst the circulating currents of PPBM are anatomized. Simulation and experimental goods are supplied to corroborate the effectiveness of the proposed rapid-fire bowl with PBM features.

2. NICOLAS BUTZEN DIS; MICHELS.J. STEYAERT, (2021). DESIGN OF SOFT- CHARGING SWITCHED- CAPACITOR DC – DC TRANSFORMERS USING STAGE OUT PHASING AND MULTIPHASE SOFT- CHARGING. IEEE JOURNAL OF SOLID- STATE CIRCUITS, 52(12), 3132 – 3141.

Banded the want for inordinate overall performance, large VCR, and inordinate- electricity viscosity absolutely included dc – dc transformers the operation of common technology, inclusively with the difficulty of reaching this because of the confined capacitance viscosity to be had in present day- day period ways. Two strategies, known as SO and MSC, have been added that hire the AM conception to soft- charge figure transfers amongst flying capacitors. As similar, the important flying capacitance can be elevated. The strategies were anatomized for a Dickson SC motor and their impact at the topological parameters changed into mentioned. A 31 Dickson SC motor come determined out, which implements those strategies to acquire an ultramodern day1.1- W/ mm² electricity viscosity and 82 performance admixture the use of common capacitor period

3. VENKATA RAVI KISHORE KANAMARLAPUDI, BENFEI WANG, NANDHA KUMAR KANDASAMY, PING LAM SO, (2018). A NEW ZVS FULL- GROUND DC- DC MOTOR FOR BATTERY CHARGING WITH REDUCED LOSSES OVER FULL- CARGO RANGE. IEEE DEALS ON ASSIDUITY OPERATIONS.

Proposed ultra-modern zero voltage switching (ZVS) complete- ground DCDC motor for battery charging is this charge. The proposed insulated DC- DC motor is used for the DC- DC conversion parchment of electrical vehicle bowl. The primary switches in DC- DC motor turn- on at zero voltage over the battery charging variety with the help of unresistant supplementary circuit. The diode setting circuit at the number one aspect minimizes the inflexibility of voltage harpoons during the secondary therapy diodes which can be generally set up in conventional complete- ground DC- DC transformers. The most important switches are managed with asymmetrical palpitation range modulation (APWM) fashion performing in better performance. APWM reduces the slice- edge stress of the primary switches and the circulating losses in comparison to the traditional member- shift modulation (PSM) system through controlling the supplementary inductor ultramodern over the total working variety of the proposed motor. The everyday-united countries evaluation of supplementary circuit and its design problems are banded in element. A hundred- kHz,1.2- kW complete ground DC- DC motor prototype is developed. The experimental consequences are handed to validate the evaluation and effectiveness of the proposed motor.

4. AHMED ELSEROUGI, AHMED MMASSOUD.; IBRAHIM ABDALLAH MASSOUD; SHEHAB AHMED, (2019). A TONE-BALANCEDBI-DIRECTIONAL MEDIUM-/ HIGH- VOLTAGE MONGREL MODULAR DC- DC CONVERTER WITH LOW- VOLTAGE COMMON DC- LINK AND SEQUENTIAL CHARGING/ DISCHARGING OF SUBMODULES CAPACITORS. IEEE DEALS ON INDUSTRIAL ELECTRONICS,

Proposes a medium-/ immoderate- voltage high- strength mongrel modular DC- DC motor to interconnect one in every of a type DC- voltage stages in medium-/ high- voltage DC grids. The motor consists of half of ground Submodules (SMs) rated at a moderate voltage degree, i.e., series connection of

semiconductor bias is avoided at the same time as connecting inordinate DC- voltage situations. The proposed structure offers tone- balancing operation, i.e., in discrepancy to traditional modular transformers, no need for capacitor voltage length, which enhances the device trust ability and simplicity. successional charging/ discharging of SMs capacitors is observed inside the proposed approach to make certain a tone-balanced operation. The proposed armature can offer an inordinate conversion rate further to strength transfer in every guideline, i.e., bidirectional DC- DC motor. Detailed illustration of the proposed system functional conception, format, and common manage tool is accessible. Simulation and experimental issues are presented to reveal the viability of the proposed configuration and validate the claims.

5. VENKATA RAVI KISHORE KANAMARLAPUDI; BEN FEI WANG; PING LAM SO; ZHE WANG, (2019), ‘ANALYSIS, DESIGN AND PERPETRATION OF AN APWM ZVZCS FULL-GROUND DC- DC MOTOR FOR BATTERY CHARGING IN ELECTRIC VEHICLES’, IEEE DEALS ON POWER ELECTRONICS, VOL. 32, NO. EIGHT, PP. 6145- 6160.

Proposed a present day zero- voltage and 0- ultramodern- day switching (ZVZCS) complete- ground DC- DC motor to reduce the energy conversion losses. The proposed motor contains a brand-new asymmetrical palpitation range modulation (APWM) gating approach for the DC- DC conversion position in the battery charging device. The proposed DC- DC motor topology achieves 0 voltage switching (ZVS) for all the lively switches and close to 0 ultramodern- day switching (ZCS) for low- side energetic switches in some unidentified time in the future of the charging variety of the battery. The proposed APWM fashion can lessen the switching and conduction losses in evaluation to the conventional phase- shift modulation (PSM) gating system. The supplementary inductance needed to make certain ZVS with APWM also can be reduced in assessment to PSM. Analysis, layout, and perpetration of the proposed APWM ZVZCS entire- ground DC- DC motor is mentioned on this design. A 100kHz,1.2 kW laboratory prototype is superior, and the experimental consequences are supplied. The issues validate the assessment and overall performance of the proposed motor.

3. EXISTING SYSTEM

DC/ DC transformers for electric powered vehicles the only of a kind configuration of EV strength deliver display that at least one DC/ DC motor is vital to affiliate the FC, the Battery or the Super capacitors module to the DC- hyperlink. In electric powered engineering, a DC- to- DC motor is a class of energy transformers and it's far an electric powered circuit which converts a source of direct contemporary(DC) from one voltage degree to any other, by the use of storing the enter electricity presto after which liberating that energy to the affair at a unique voltage. The storehouse may be in both glamorous region garage complements (inductors, mills) or electric concern storehouse complements(capacitors). DC/ DC transformers can be designed to switch energy in only one route, from the enter to the affair. still, nearly all DC/ DC motor topologies can be made-directional. Abi-directional motor can circulate electricity in each direction, it's salutary in packages taking regenerative retardation. The quantum of strength goes with the pier among the center and the affair may be controlled by means of conforming the responsibility cycle (rate of on/ off time of the transfer). generally, that's achieved to manipulate the affair voltage, the input present day- day, the affair present day- day, or to save a regular energy. Motor grounded completely transformers may offer insulation some of the center and the affair.

The main downsides of switching transformers encompass complexity, electronic noise and inordinate value for a many topologies. numerous exclusive feathers of DC/ DC energy transformers are proposed in literature (Chiu & Lin, 2006), (Fengyun et al., 2006). The most not unusual DC/ DC transformers may be grouped as follows.

4. PROPOSED SYSTEM

This oils specializes in amulti-port model predictive controller primarily grounded surely non-isolated (Binary enter and single affair) DC/ DC energy elec- tronic interface grounded on Z- Quasi resonant (ZQR) network. The block illustration of proposed motor is established in Figure.

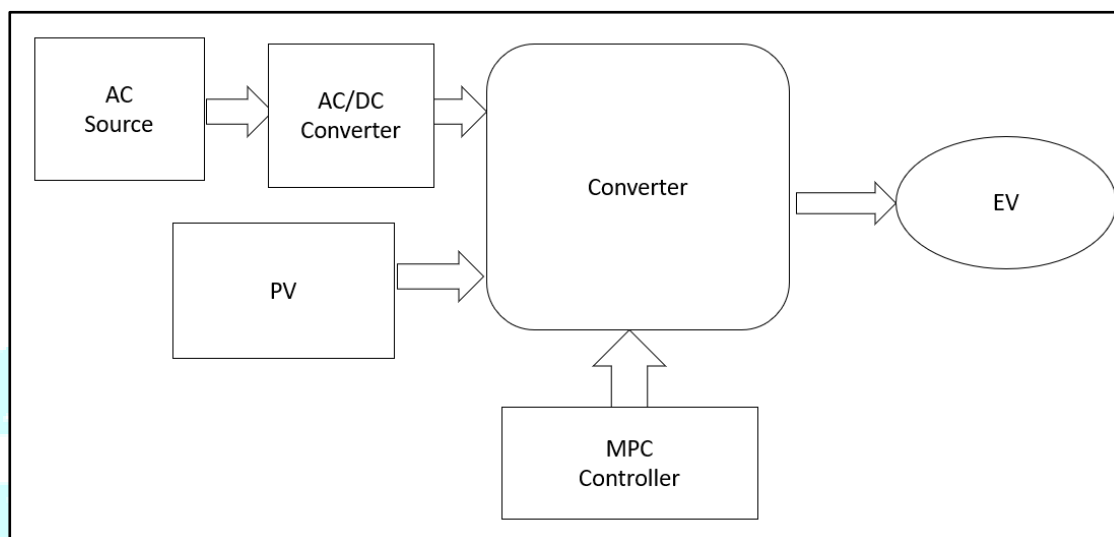


FIGURE 1. PROPOSED SYSTEM BLOCK DIAGRAM

The motor carries grid and Photovoltaic panel (PV) as its in- deposited means. Unlike the number one DC/ DC transformers, the recommended DC/ DC motor requires smaller switches and gives on- forestall dastard- parcel, inordinate gain in voltage, and minimal voltage strain on motor transfer as a lot as forty obligation cycle due to the presence of ZQR community. This point of the motor makes it to and its software program in Electric Vehicle (EV) off- board charging in which inordinate voltage benefit is re- quired. In the proposed multi-port ZQR motor, lesser enter and affair anchorages might be added without compromising the motor's gain and overall performance. The evolved motor can serve constantly indeed though any character of the enter means fails to rate the EV. The proposed motor is mathematically modeled using simple laws that govern the motor overall performance and anatomized in MATLAB Simulink platform below vari- ous working modes. A mongrel strength contrivance, which mixes several renewable en- ergy means with colorful voltage/ present day developments, is pivotal. As proven in Figure three, the proposed 3- harborage non-remoted ZQR DC/ DC motor has one PV harborage, a remedied affair from the grid harborage, and an affair harborage. The specific of the motor for this reason furnished opens a slice- edge horizon within the area of EV battery speedy charging.

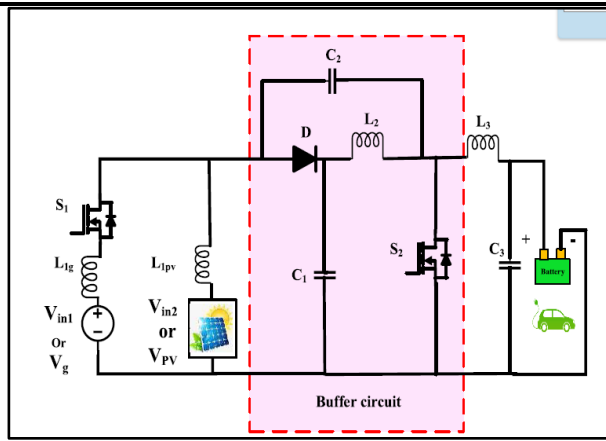


FIGURE 2. PROPOSED THREE PORT ZQR DC/DC CONVERTER.

5. RESULT AND DISCUSSION

The Simulink model of proposed multi-port converter with closed loop controller

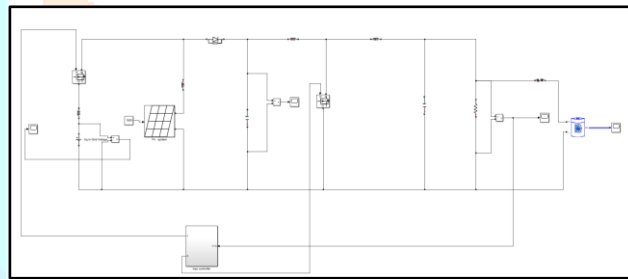


FIGURE 3. SNAPSHOT OF PROPOSED MODEL

The above figure shows the experiments were done for an DC input voltage with wit solar for varying resistive load. The tests were carried out for different load conditions.

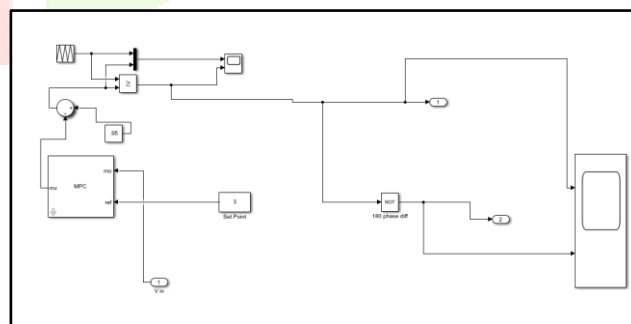


FIGURE 4. MPC CONTROLLER SNAPSHOT

The above figure shows the MPC controller model for improving the gain of proposed multi-port converter. The pulse for controlling switches is generated from MPC. The MPC is a variable structure control method. The multiple control structures are designed so that trajectories always move toward an adjacent region with a different control structure, and so the ultimate trajectory will not exist entirely within one control structure.

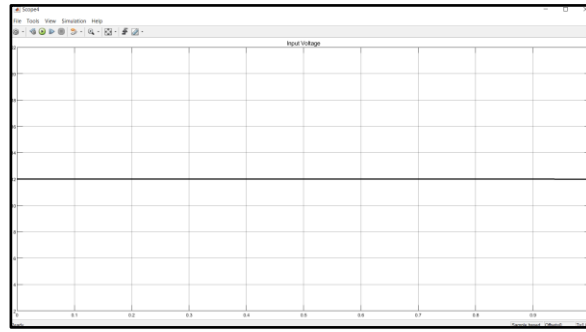


FIGURE 5. DC INPUT VOLTAGE SNAPSHOT

The above figure shows the source DC voltage and current for conversion. The DC voltage at the output side is constant, and it is maintained at 12 V.



FIGURE 6. SOLAR VOLTAGE

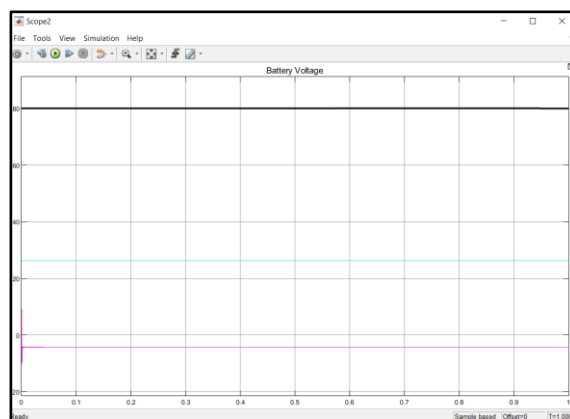


FIGURE 7. PROPOSED OUTPUT VOLTAGE

The above figure shows the DC voltage of proposed converter with MPC the proposed multiport ZQR converter has the ability to charge EV battery at low duty cycle. The validation of high output gain and efficiency of multiport ZQR converter, for different duty cycles with constant input voltage is carried out.

Converter	Component	Isolation	Gain
Boost converter	7	No	6
Interleaved boost converter	6	No	6
Isolated boost	7	Yes	6.8
Proposed	6	No	8.2

To anticipate a comparable cost, the quantity of switches, transformers, capacitors, diodes, and inductors utilized in various DC/DC converters must be reduced. Experimental output results of all Table present the simple component and voltage gain comparison of converter topologies discussed in this work. The proposed converter shows higher gain with moderate area cost.

6. IMPLEMENTATION RESULTS



7. CONCLUSION

In this adventure, a modified MPC multiport ZQR DC/ DC motor for our board EV battery charging come proposed. The proposed motor has the advantages of superior step- up rate, dropped transfer voltage stress, on-forestall ultramodern indeed at zero. Four duty cycle. The motor has the function of strength sharing among the input anchorages and supplying constant electricity to EV battery indeed in the absence of any person deliver. The verified experimental consequences show the principle of operation and validate the furnished theoretical and simulation analyses in expressions of everyday country, dynamic and loss analyses. Though the discrepancy of proposed multiport ZQR DC/ DC motor with traditional transformers proves the efficacy of the designed motor, it has its own trouble of forbidding the gain to 3 times with a single reverberative buffer unit. The abovesaid dilemma can be overcome with the addition of redundant buffer bias in parallel. Eventually, the results

supplied to corroborate the design fashion, and normal overall performance of the motor topology confirms the counseled topology as a possible answer for EV off board charging.

8. REFERENCES

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