A Review on Ride-Through in Hybrid Energy Storage System

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Abstract— Recently electric vehicles plays an important role in various fields such as lift application traction for its controlling features. Due to the degradation of fossil fuel various automotive industries have taken step forward to realize electricity in vehicle by replacing fuel. So in order to overcome this problem a new approach to the combination of ultracapacitor and battery is introduced. This paper presents a review on improvement in variety of power level which is overcome with rid through mechanism and for that, bidirectional dc-dc converter is used..

Key words: ultracapacitor, battery, ride-through, bidirectional dc-dc converter, hybrid energy storage system

I. INTRODUCTION

IN fraction to the increasing application of ride-through in commercial and industrial facilities, ride-through issues have been more and more emphasized. As the problem have been increased and much research of ride-through system have been performed all over the world. Ride-through solutions are classified as follows:

- To existing adjustable speed drive topology modification.
- Modification to advanced hardware.
- Energy storage technologies.

The various energy storage technologies are used for providing full power ride-through, for example battery backup system, ultracapacitor, fuel cell, flywheel can be used [2]-[7]. In the electrical energy storage ultracapacitor or ultracapacitor is one of the modern innovations. The charge and discharge of ultracapacitor can be for more than a few thousands of times liken to battery. Ultracapacitor are well known for their high cycle lifetime, tremendously high power (HP) density and cycling competence. The high precise energy batteries with high precise power ultracapacitor combine to make a hybrid energy storage system (HESS) [1]-[3]. The power between the sources is passively distributed. The secondary source capability cannot be used entirely in the hybrid system. Therefore, between the main source and the secondary source dc-dc power converter might place [5]. Energetic distribution of energy between the drive and the ultracapacitor, organize of dc bus voltage and ultracapacitor status of charge control are depends on the system condition of the converter organize system. An Controllable bi-directional dc-dc converter with the intention of one input and one output. It could be, for example, a multiphase interleaved converter, two-level or three-level non isolated converter [16]-[19], cascaded buck-boost capacitor in the center (CBBCIM) and cascaded buck-boost inductor in the center(CBBIIM) [17], multiple input bidirectional converter [18], series resonant dc-dc converter (SRC) [24]. The control variable that is the duty cycle, stage shift or switching frequency, dependent on the converter topology is controlling the converter [6]. When isolation stuck between source and load is necessary for high power function, isolated topologies of dc-dc converter associated in parallel have to be used. In addition, using parallel converter composition allows optimizing the worldwide efficiency [9].

II. RIDE-THROUGH SYSTEM

Energy storage is essential component of ride through system. The technology high power density is preferred for adjustable speed drive (ASD) ride through application but the essential energy density is relatively low in contrast to traditional uninterruptible power supply (UPS) system. 100KW load is supplied by ADS for 5 second ride-through system (RTS) using ultracapacitor for energy storage shown in fig.1 [2]. The sophisticated proscribed electric drives are still having two issue for design and applications:

1) Improvement of braking energy and
2) The restrict system ride-through capacity.

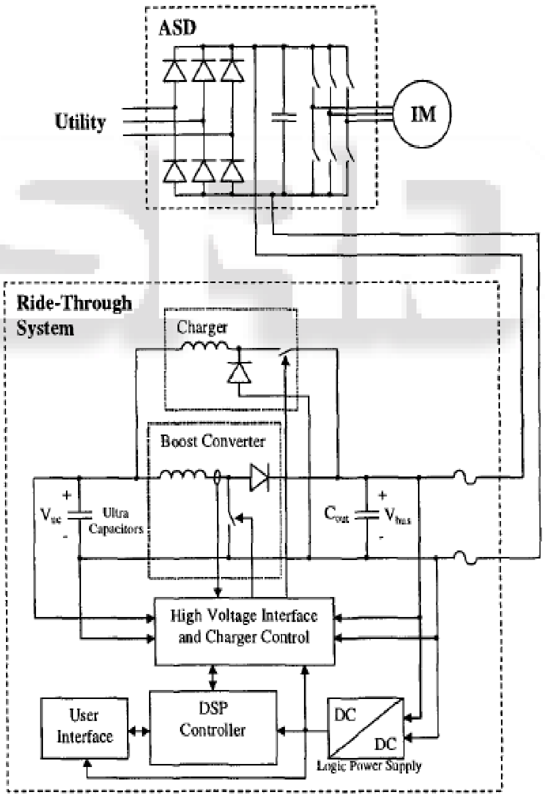

Fig. 1: RTS block diagram [2].

This paper discussed about extended ride-through capability by a regenerative controlled electric drive [6]. Energy storage technology with the category of press forward hardware modification, a new ride-through system for ASDs is proposed. Alteration of move forward hardware and the use of energy storage technologies are the two schemes whose advantage is taken. In suggested system the voltage rating can be diminish in energy storage device about one third of the rating of the conventional energy storage devices, which reduce the space for the energy storage devices and the cost. The ordinary mode voltage natural is used in a PWM boost-inverter system; under normal condition of the source power it can change the energy storage devices. That is driving motor can regulate changing current and controlling the common-mode voltage. Voltage disturbances from small voltage sag to full outage by adding a simple circuit in parallel to the existing rectifier, ride-through is successively provided [7].

III. HYBRID ENERGY STORAGE SYSTEM

Ultracapacitor take action as a power buffer to charging/discharging sail through out power and to diminish overall energy storage system (ESS) amount and expand the battery cycle time. Battery/ultracapacitor (UC) hybrid energy storage system (HESS) has been deliberated. Optimization of battery cycle life and an integrated structure for HESS sizing base on battery cycle life deprivation model is planned. After 3650 rotation the battery ability overcome should be at least less than 20% in electrical vehicles (EV) to have life of 10 year. For an EV 150 high energy (HE) battery cell are wanted with range condition of 100 miles. However they cannot satisfy the power require. For over sizing the HE battery, the power demand and the high discharge/charge current condition of load is content. In this case, HESS can help to decrease the load power strain on batteries and decrease the battery size by hybridizing them with UCs. To optimize the HESS load and battery cycle life a multi objective optimization is formulate using DIRECT algorithm. The optimized HESS below urban driving can expand the battery lifetime by 76% with 72 UC cell. The system diagram of HESS pattern is shown in fig.2 [1]-[10]

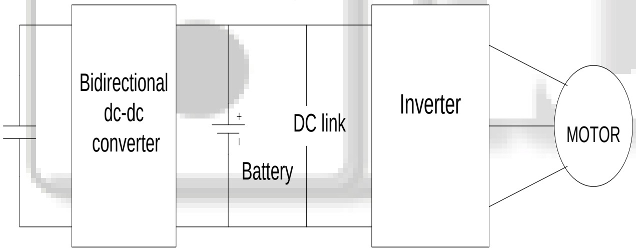

Fig. 2: scheme diagram of the UC/battery configuration for HESS [1].

To create a hybrid energy storage system (HESS) the amalgamation of high precise energy batteries with high precise power ultracapacitor are linked so as to decreases the strain on the battery throughout transient operating situation. The hybrid energy storage system is shown in fig.3 [3]-[8]-[10]-[12]-[14]. Controlling of power flows between a fuel cell, a storage space device constitute by an ultracapacitor store, and a resistive load has accessible a flatness base control of an electrical hybrid scheme [5]-[9]-[18].

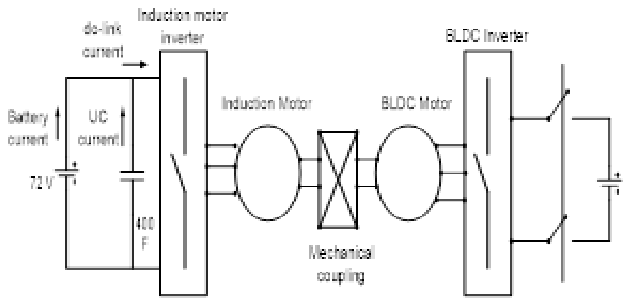

Fig. 3: hybrid energy storage system with motor generator set connection diagram [3].

A load voltage control loopincludingfor powering pulsed current load design of a battery ultracapacitor semi active hybrid. The ultacapacitor and battery bank are associated in parallel and directly connected to the load is passive topology [11]-[14]. An energetic grouping of UCs and Li-ion batteries has been planned because of the disadvantage of ultracapacitor and batteries. In HEV the presentation competition for the active combination energy storage space system (ACES) is much additional complicated. The power command from the HEV and the capability of ACES are the idea of the power energy (PE) purpose. The presentation of the ACES on the foundation of analyze ESS working from the target HEV by means of PE meaning is accessible. The supplies from the power demand and the potential of the ESS is illustrate by the impression of the PE function [12]. In [13] for a plug in electric city bus (PECB), a comprehensive comparative study of optimal sizing of battery, ultracapacitor and battery ultracapacitor hybrid energy storage system (HESS) has been calculated independently. For this swam optimization process is met heuristic population based technique used for solving the best sizing troubles. Manage of a battery semi active hybrid energy storage system is discuss and a multi agent based on modeling and encoding surroundings, Net Logo is used to stand for different individuality of HESS [14].

IV. BIDIRECTIONAL DC-DC CONVERTER

In [6]-[16], the border power converter a bidirectional three level dc-dc is measured stuck between the ultracapacitor and the drive dc bus. The normal two level dc-dc converter is compare with three level converter is highlighted. This estimation has two important advantages the switch voltage rating and the amount of the filter inductance. A novel control algorithm and the edge dc-dc converter topology have been temporarily obtainable. The exercise of three port isolated dc-dc converter used in order to have galvanic separation for a high electrical energy ratio and security reason. To reduce the number of exchange in the hybrid power source a multiport converter is used. The two three-port inaccessible dc-dc converter are built with the foundation using parallel converter structure permit optimizing the global efficiency [9]. The transmission losses and the switch losses both include in a dc-dc converter for HESS energy organization problem. To avoid low competence operation on precise model of the dc-dc converter is built-in and obtainable to give insight on the HESS power flow control. Bidirectional dc-dc converter is used to border the UC to the dc bus is shown in fig.4.Particularly for the high frequency application switching losses improve the accuracy of the loss model [10]-[23].

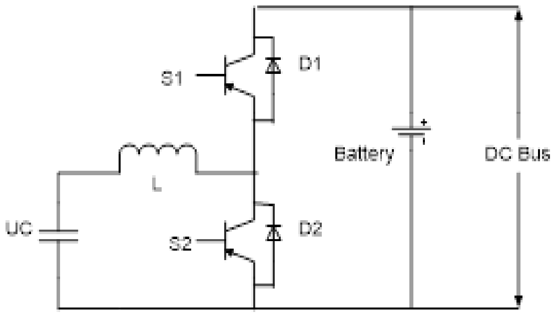

Fig. 4: Bidirectional dc-dc converter in the HESS [10].

The most common kind of connection is shown in fig.5. in its place of conservative two quadrant buck/boost converter (CBC), which would diminish the size of the magnetic mechanism and boost the conversion efficiency, the power electronic border between the battery and the ultracapacitor by means of a three-level non-cut off bidirectional dc-dc converter has been planned. At high switching frequencies the three-level converter has the negligible size magnetic component and improve the efficiency [16]-[19].

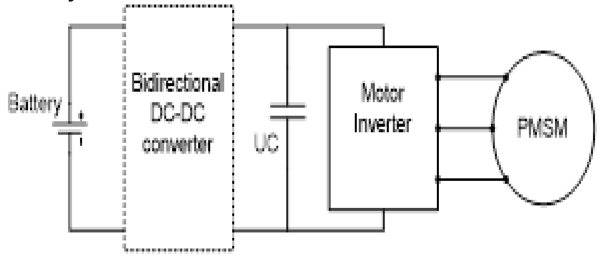

Fig. 5: Drivetrain of the battery/UC vehicle with a bidirectional converter[16].

In plug-in electric and hybrid electric vehicles the comparisons of two types of bidirectional dc-dc converter cascaded buck-boost capacitor in the middle (CBBCIM) and cascaded buck-boost inductor in the middle (CBBIIM) has been presented. Since the input side and output side control are independent, CBBCIM can have better performances, flexibility and reliability of the system control [17]. To interface more than two sources of power/energy operation at different voltage level multiple input bidirectional dc-dc converter is used. When additional than two sources are active it is possible to control the power stream between each pair of sources independently [18]. In [20]-[22] power inductor in bidirectional dc-dc is focused on core size optimization. To increase the passing performance of dc-dc converter inductor with additional auxiliary winding recently has been used. A rechargeable battery and an ultracapacitor is used by a double- input bidirectional dc-dc converter. The converter was able to move energy between the UC and battery, simultaneously steady voltage of the compartment without using a voltage sensor [21]-[22]. The conventional series resonant dc-dc converter (SRC) to attempt as a pace up and pace down converter presented the analysis and design of a novel technique. A bi-directional dc-dc converter that be able to move power up to 6KW. Dual animated bridge (DAB) is well known option to the SRC. SRC presents better efficiency for light load which is major advantage of this converter [24].

V. Conclusion

In modern electric vehicles or drives, a combination of ultracapacitor and batteries can provide better efficiency and improved battery life. In this paper battery ultracapacitor is proposed to serve as a ride through for battery, thus improving battery life and providing continuous power to the load. The ride-through capability extended by analyzing of the ultracapacitor based regenerative proscribed electric drive. The completion of the current proscribed dc-dc bidirectional converter has been studied. Using parallel converter compound allows optimizing the global efficiency.

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