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FLUCTUATING POWER DECOUPLING TECHNIQUE FOR 1 PHASE AC-DC CONVERTER THROUGH A SYMMETRICAL HALF BRIDGE CIRCUIT

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ABSTRACT

Single-phase ac/dc or dc/ac systems are inherently subject to the harmonic disturbance that is caused by the well-known double-line frequency ripple power. This issue can be eased through the installation of bulky electrolytic capacitors in the dc link. However, passive filtering approach inevitably lead to low power density and limited system lifetime. An alternative approach is to use active power decoupling so that the ripple power can be diverted into other energy storage devices to gain an improved system performance. all existing active methods have to introduce extra energy storage elements, either inductors or film capacitors in the system to store the ripple power, and this again leads to increased component costs.

In the proposed project, we use a symmetrical half-bridge circuit, which uses minimum components and reduced size of the capacitors used to absorb the ripple power. Here only two capacitance of lesser value and two switches are used. The simulation is carried out with the MATLAB software and the prototype made for the same with lesser wattage for verifying the results. It shows that at least ten times capacitance reduction can be achieved with the proposed active power decoupling method.

Keywords: AC-DC Converting circuit, Boosting of voltage, Decoupling of power,

I INTRODUCTION

Ac/dc or dc/ac power electronics systems have extremely wide applications in residential and industrial power supplies or conversion systems. Example applications are front-end power factor correction (PFC) converters in consumer power supplies, on-board chargers for plug- in hybrid electric vehicles, and 5-kW (or less) grid-connected photovoltaic (PV) inverters for distributed power generation .A well-known problem with such systems is that their ac-side instantaneous power contains a fluctuating component that changes at twice the fundamental frequency.

This fluctuating power is adverse to the system performance because it may potentially cause distorted input current of PFCs, over- heating of batteries, and decreased maximum power point tracking (MPPT) efficiency of PV systems. A very straight- forward way to mitigate its negative impact is to use bulky electrolytic capacitors in the dc link so that they can act as buffers to the ac-side ripple power. However, those electrolytic capacitors are known to have high equivalent series resistance (ESR) and low ripple current capability, and their lifetime is also relatively short (several thousand hours) when stressed with the nominal voltage and the ripple current. Therefore, they may cause troubles in some applications where 20- or 25-year warranty period is required, e.g., LED drivers and solar inverters.

Some active power decoupling methods have been proposed to cope with this problem and the fundamental principle behind them is to introduce an extra active circuit in the system, so that the ripple power can be shifted away from the dc link and stored by other components with expanded lifetime, e.g., inductors and film capacitors, in a more efficient and effective way. In order to achieve a simple and compact design and to break the limitation imposed by the front-end topology, this paper proposes a new topology to realize active power decoupling. Two identical film capacitors are employed and connected in series in the dc link, whose midpoint is then connected to another phase leg through a small filtering inductor. In this way, the dc-link capacitors may not only provide a high-voltage dc bus to support ac/dc or dc/ac conversion, but can also absorb the system ripple power. The added symmetrical half-bridge circuit is also easy to control, because the voltages of the two-film capacitors will both be sinusoidal. Moreover, the capacitors can be alternatively discharged to zero in case that high ripple power compensation is required, and the power decoupling can be accomplished without using additional energy storage inductors or capacitors.

II PROBLEM STATEMENT

Single-phase ac/dc or dc/ac systems are inherently subject to the harmonic disturbance that is caused by the well-known double-line frequency ripple power. This issue can be eased through the installation of bulky electrolytic capacitors in the dc link. The passive filtering approach may inevitably lead to low power density and limited system lifetime. An alternative approach is to use active power decoupling so that the ripple power can be diverted into other energy storage devices to gain an improved system performance. in this project we use symmetrical half-bridge circuit, which utilizes the dc-link capacitors to absorb the ripple power, and the only additional components are a pair of switches and a small filtering inductor.

III METHODOLOGY

The fig 2.Shows the block diagram of the proposed circuit. The input is ac supply and the output is DC with boosted output. The driver circuit is used to drive the mosfet as it requires more than 12V at its gate-source point and this circuit amplifies the 5V pulses from microcontroller to 12V pulses, And TTL logic pairs protects the controller from damage.

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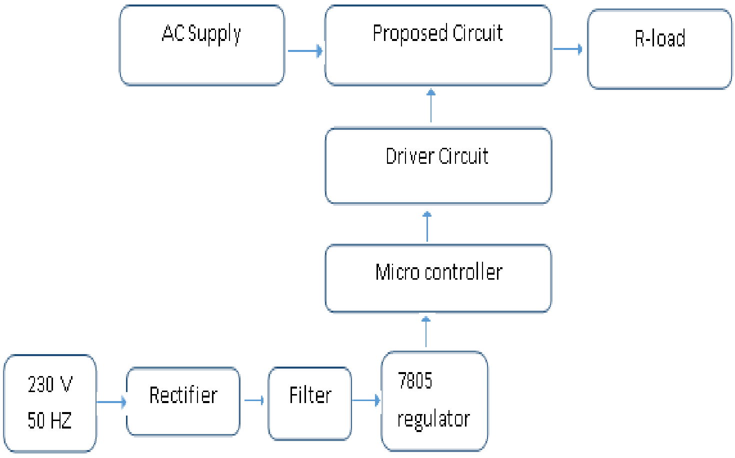

Fig 2. Block Diagram of proposed circuit

IV FIRMWARE

After the designing of the main circuit, the simulation is carried out to see the results. In addition, after getting the expected results hardware is implemented as per the ratings given.

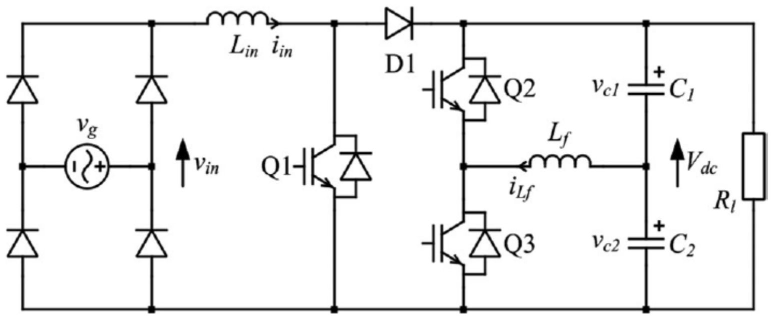

Fig 1.Proposed Circuit Diagram

The below circuit shows the AC to DC converter with bridge rectifier and boost converter with ripple reduction block with capacitors to reduce the ripple

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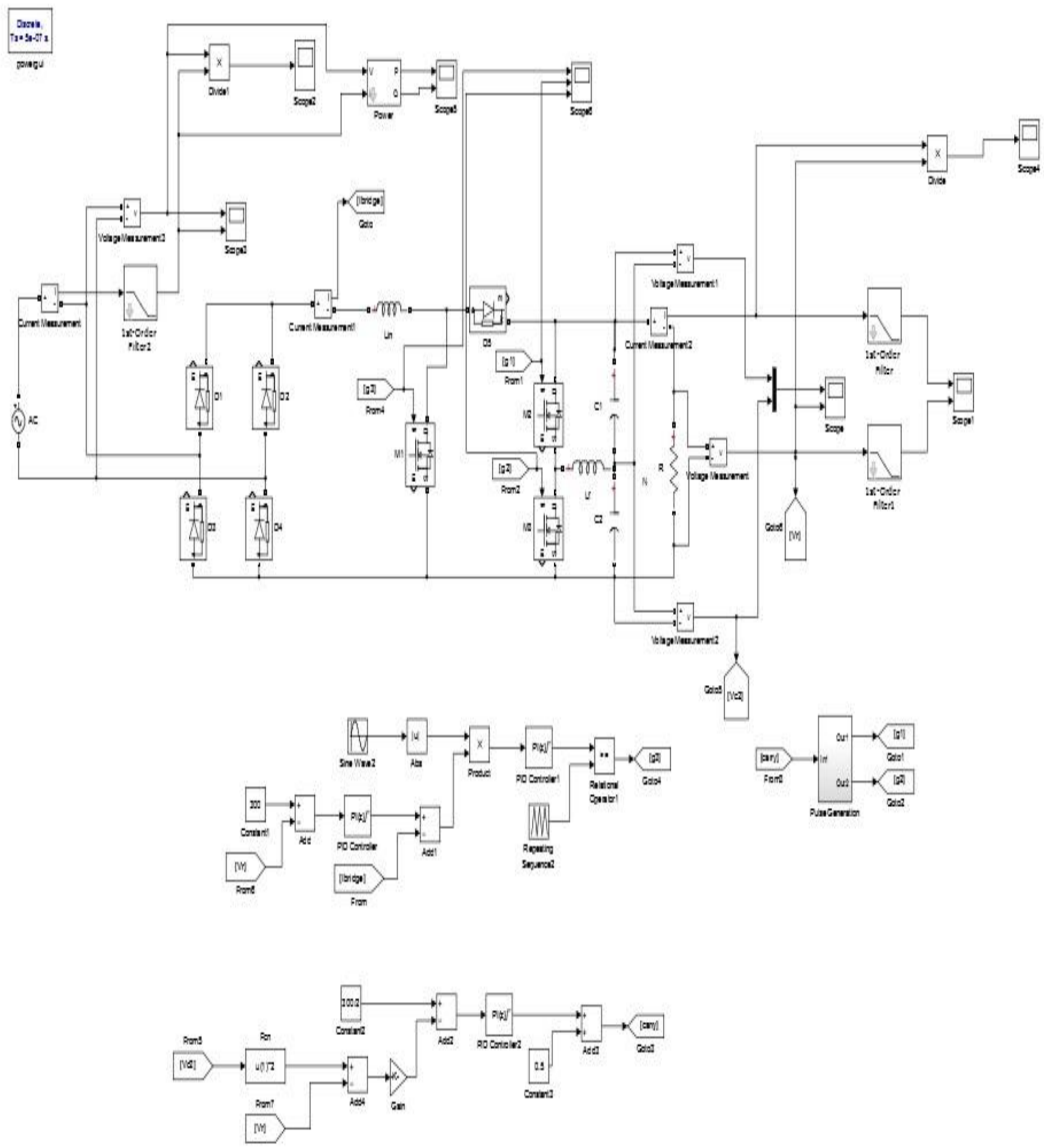

Fig.2 Simulation circuit for proposed topology

V RESULT

This project discusses a symmetrical half-bridge circuit to decouple the fluctuating power in single-phase ac/dc and dc/ac systems. The dc-link capacitors in the proposed system may not only provide a high-voltage dc bus to support power conversion, but also absorb the system ripple power originated from the ac side. The resulting system is more cost-effective as compared to other existing active power decoupling methods because itdoes not need additional passive components to store the system ripple energy

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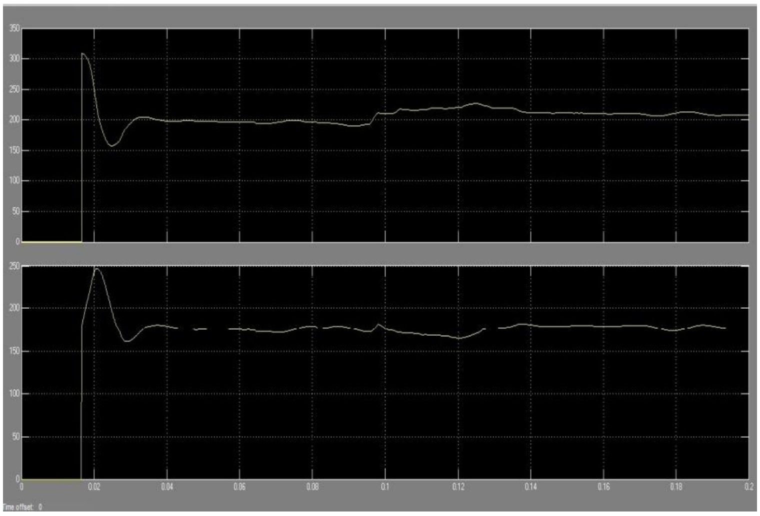

Fig.3 Input active and reactive power

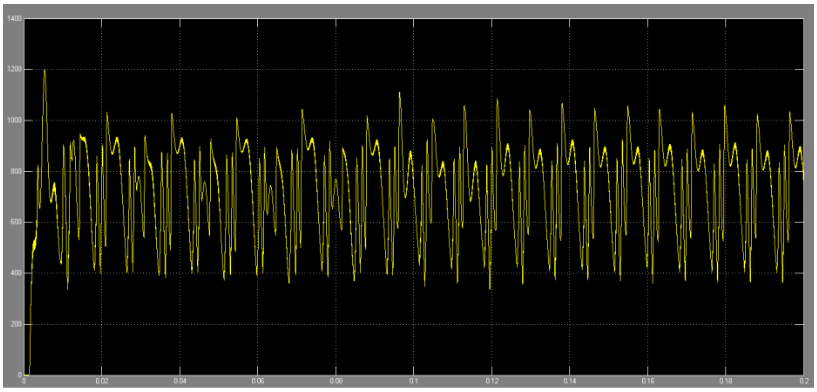

Fig.4 output power

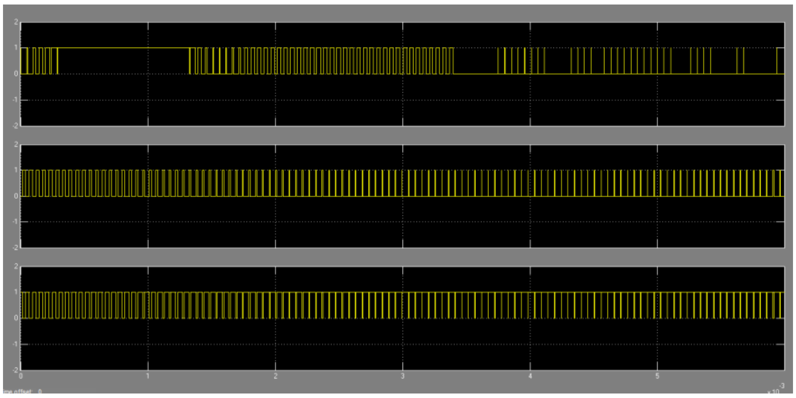

Fig.5 switching pulses for MOSFETs

VI CONCLUSION

. Experimental results under both steady-state operations were obtained from a 100 W PFC prototype and it shows that at least ten times capacitance reduction can be achieved by the proposed active power decoupling circuit. The ripple voltage in the dc link as well as the THD of the gird current can be significantly reduced, which proves the effectiveness of the proposed solution. The proposed symmetrical half-bridge can also be regarded as a generic converter cell and might be a promising solution for elimination of the fluctuating power and the reduction of dc-link capacitance in other advanced topologies, e.g., NPCs and MMCs.

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