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12-Pulse Diode Rectifiers for Storage of Energy Integration and AC Harmonic Elimination

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Abstract:
The 12-pulse rectifier is often used to supply high power industrial loads. Its ability to effectively and cheaply mitigate the harmonics on the ac side has ensured its dominance in the industry even as active front ends become cheaper and more reliable. Despite its many benefits, the 12-pulse rectifier is not able to reduce the ac-side harmonics to a level acceptable by the pertinent IEEE standards without additional filtering. In this paper, we outline a novel method to profile the rectifier output current to be triangular which results in low ac-side harmonics. The novelty in the proposed approach is that we exploit the dc-side filter design to minimize the volt-amperes VA rating of the current source used to profile the dc-side rectifier current. Additional benefits of the proposed method include lower VA rating of the dc filter, simple integration of dc energy storage, and effective ac harmonic control even when the initial rectifier current is discontinuous. Availability of reliable and inexpensive semiconductor devices has led to numerous power electronics intensive industrial loads requiring dc power supply for operation. When a number of dc-powered loads are in proximity, it becomes viable for them to share a common dc bus.

Introduction:
Availability of reliable and inexpensive semiconductor devices has led to numerous power electronics intensive industrial loads requiring dc power supply for operation. When a number of dc-powered loads are in proximity, it becomes viable for them to share a common dc bus. Many such systems benefit from local dc storage to perform the following:

Reduce the power demand from the grid; 2) provide backup power; and 3) store locally generated renewable power rather than feeding it back to the grid. Local dc distribution has been considered for data centers, dc-level plug-in vehicle charging stations, more electric ships, and aircrafts. The 12-pulse rectifier is a common, simple, and cost effective method to provide a stable dc supply while at the same time minimizing the grid-side harmonics. The 12-pulse rectifier is a good tradeoff between harmonic reduction and subsystem complexity and is commonly used in the industry. However, the 12-pulse rectifier alone does not sufficiently reduce the ac harmonics to a level prescribed by relevant standards.

A standard way to eliminate ac-side harmonics is to use active, passive, or hybrid power filters. Although these methods are well understood and widely used, passive filters are bulky, while active filters require complex control and specialized power electronics. An alternative method controls the current draw from the dc side so as to minimize the ac harmonics. Researchers have shown that, for the 12-pulse rectifier, the ac-side harmonics are minimized by shaping the two six-pulse rectifier output currents to be triangular and out of phase.

The resulting total harmonic distortion (THD) is as low as 1%.Researchers exploit this property; while effective at reducing the harmonics, the circuitry used to shape the current is placed in path of the load current, resulting in substantial VA rating. In this project, we propose a new method of profiling the dc-side rectifier current by using current sources placed in parallel with each six-pulse rectifier bridge to inject current and shape the rectifier output current.

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PROPOSED METHOD FOR HARMONICS REDUCTION AND ENERGY STORAGE INTEGRATION:

A novel approach proposed in this paper inserts three current sources into the circuit as shown in Fig. The two current sources (is1 and is2) in parallel with each rectifier are used to Shape the rectifier currents irec1 and irec2 in order to eliminate the ac-side harmonics. The third current source is3 is used to inject active power from an energy storage system. In addition to providing the ability to inject real power on the dc side, we will show that, with the correct choice of the LC filter parameters, the VA rating of the current source used for filtering can be substantially reduced compared, for example, to the direct current profiling case. A direct comparison with other proposed solutions is more difficult, since the VA ratings of the voltage source will be a function of the design of the entire system.

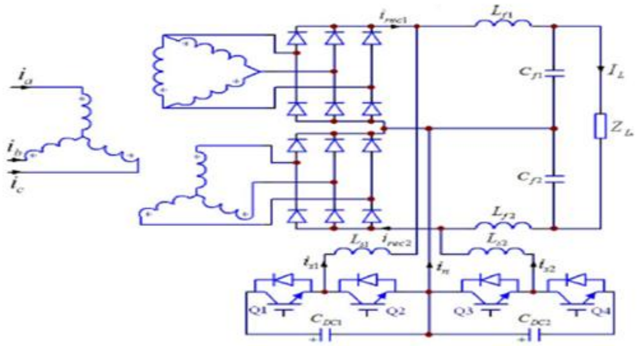


FIG 1:Configuration of the proposed ac/dc rectifier with current sources formed by two buck-and-boost converters.

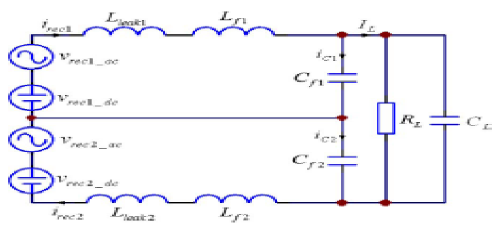


Fig 2: Equivalent circuit of the 12-pulse rectifier

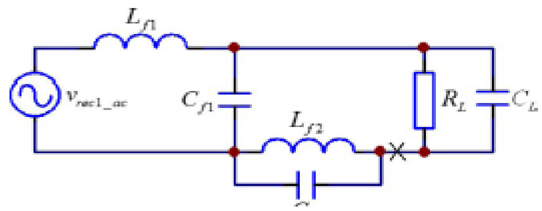


Fig 3: Decoupling of the currents produced by the fundamental of vrec1_ac.

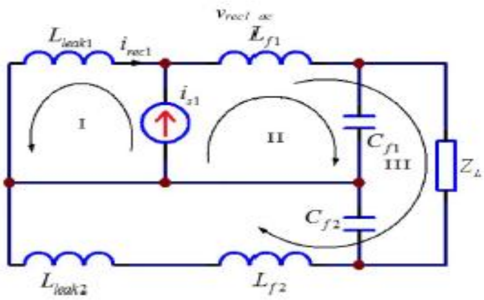


Fig 4: Equivalent circuit forthe upper current sourceusing the superposition principle.

CONTROL STRATEGY:

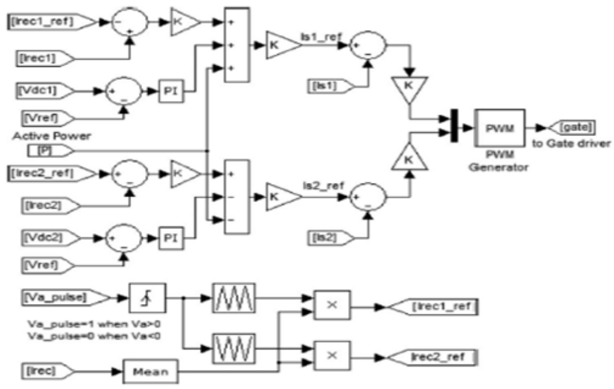


Fig 5:Configuration of control strategy

- In the On-state, the switch S (see figure 1) is shut, bringing about an increment in the inductor current;
- In the Off-state, the switch is transparent just way offered to inductor current is through the flyback diode D, the capacitor C and the heap R. This outcomes in exchanging the vitality collected amid the On-state into the capacitor.
- The information current is the same as the inductor present as can be found in figure 2. So it is not intermittent as in the buck converter and the

necessities on the data channel are casual contrasted with a buck converter.

Buck-Boost Converter:

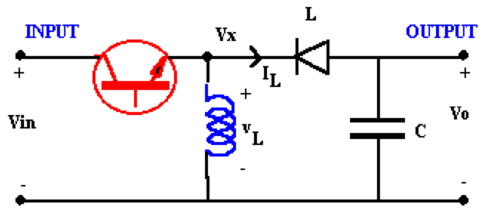


Fig 6: schematic for buck-boost converter

With ceaseless conduction for the Buck-Boost converter Vx =Vin when the transistor is ON and Vx =Vo when the transistor is OFF. For zero net current change over a period the normal voltage over the inductor is zero

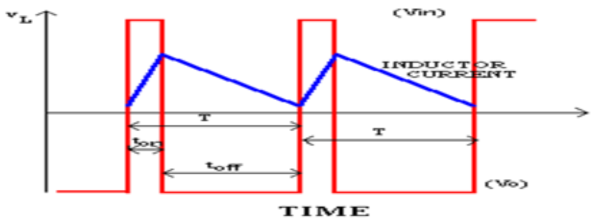


Fig 7: Waveforms for buck-boost converter

Converter Comparison

The voltage proportions achievable by the DC-DC converters are abridged in Fig.2.2.4. Notice that just the buck converter demonstrates a direct relationship between the control (obligation proportion) and yield voltage.

SIMULATION RESULTS:

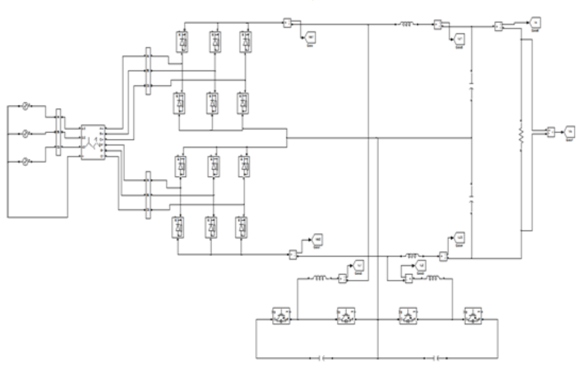
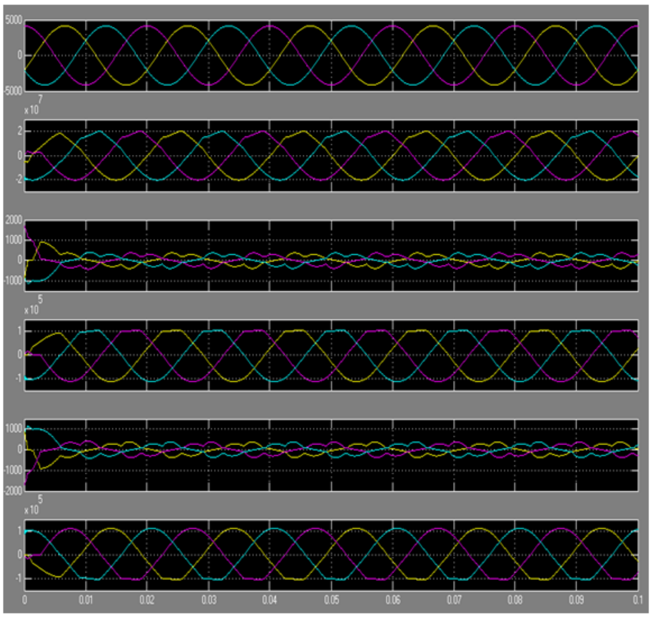
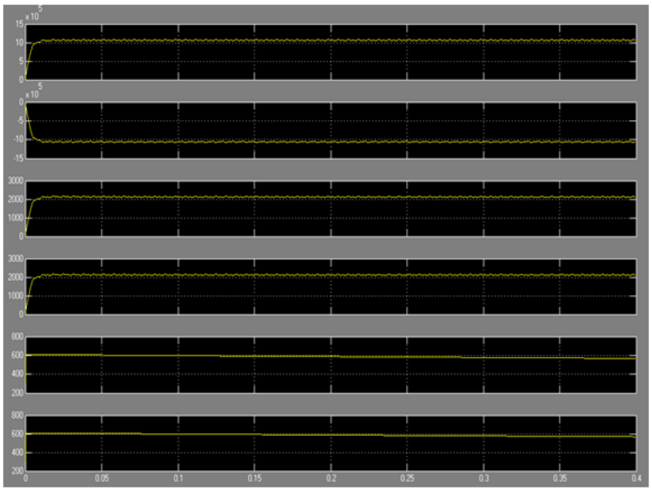
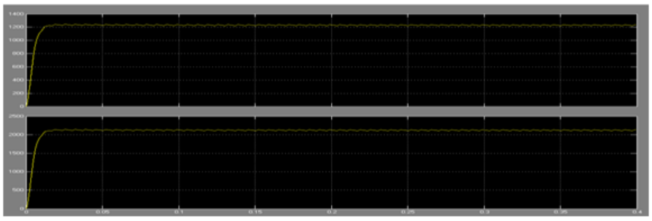


Fig 8: Simulation block diagram of 12-pulse diode rectifier







CONCLUSION:

In this paper, we have presented a new method for active profiling of the 12-pulse rectifier output current. The chosen topology acts as a current source in parallel with the input rectifier and is therefore not in the path of the load current.

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In addition, the current source is constructed from a voltage-fed buck-and-boost converter, allowing for seamless integration ofdc storage into the system. The VA ratings of the current profiling circuitry are further minimized by exploiting the resonance of the dc-side LC filter. In comparison with similar approaches, the proposed method has apparent advantages of eliminating the use of low frequency transformers for shaping the rectifier output current, providing energy storage interface to the system and functioning regardless of the continuality of the initial rectifier output current. Simulation of a high-power industrial ac/dc rectifier verified the parameter optimization of the system, while experimental results show significant reduction of harmonics in the line current. The dc energy storage integration functionality is also verified experimentally.

FUTURE SCOPE:

- 12-Pulse to 24-Pulse.
- For high voltage rated applications.

REFERENCES:

[1]V.Sithimolada and P.W.Sauer, "Facility-levelDCvs. Typical AC distribu-tion for data centers: A comparative reliability study," in Proc. TENCON, 2010, pp. 2102–2107.

[2] S. Bai, D. Yu, and S. Lukic, "Optimum design of an EV/PHEV charging station with DC bus and storage system," in Proc. IEEE Energy Convers. Congr. Expo., 2010, pp. 1178–1184.

[3] H. Zhang, F. Mollet, C. Saudemont, and B. Robyns, "Experimental val- idation of energy storage system management strategies for a local DC distribution system of more electric aircraft," IEEE Trans. Ind. Electron., vol. 57, no. 12, pp. 3905–3916, Dec. 2010.

[4] IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems, IEEE Std. 519-1992, 1993.

[5] L. An, T. Ci, S. Z. Kang, Z. Wei, R. Fei, and Z. Ke, "A novel three- phase hybrid active power filter with a series resonance circuit tuned at the fundamental frequency," IEEE Trans. Ind. Electron., vol. 56, no. 7, pp. 2431–2440, Jul. 2009.

[6] A. Bhattacharya, C. Chakraborty, and S. Bhattacharya, "Parallel con- nected shunt hybrid active power filters operating at different switch- ing frequencies for improved performance," IEEE Trans. Ind. Electron., vol. 59, no. 11, pp. 4007–4019, Nov. 2012.

[7] S. Ostroznik, P. Bajec, and P. Zajec, "A study of a hybrid filter," IEEE Trans. Ind. Electron., vol. 57, no. 3, pp. 935–942, Mar. 2010.

[8] Y. Liu, N. Watson, and J. Arrillaga, "A new concept for the control of the harmonic content of voltage source converters," in Proc. IEEE Conf. Power Electron. Drive Syst., 2003, vol. 1, pp. 793–798.