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Tidal Power Generation using DC Generators with Power Converter

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Abstract

In general Tidal Power Generation (TPG) involves more than one turbine. If the generated power is low, single source boost converter can't able to provide power continuously. This paper presents a multi-tidal based multiport DC-DC converter with Single Switch Boost Rectifier (SSBR) is used increased voltage gain is proposed. Further the proposed multiport DC-DC converter illustrates lesser harmonics in the output current. More than one source is used in proposed multi port dc-dc converter to continuously supply reliable power. The simulation of proposed DC-DC multi-port converter is done in MATLAB/Simulink environment and to verify merits of proposed converter, the results are presented.

Keywords: Tidal Power Generation (TPG), PMSG, Total harmonic distortion (THD).

1. Introduction

Single source sustainable power source based lift converters can't supply inverter or a drive whenever delivered yield from source is less. Consequently for a converter activity of inverter if more than one source is utilized is conceivable with both of the source. Multi-port converter is incorporated at least a sources like sunlight based higher power point. It is based on PMSG and lift converter with wind based single switch control factor-adjustment. The rectified is improving factor of control and accomplish low complete symphonious contortion control converter. In this system a control framework is changeless PMSG based breeze vitality framework. PFC rectifier for PMSG based breeze framework. Multiport dc-dc converter with three sources of info PV, battery, and super capacitor for dependable activity. A receptive power controller for control quality improvement of wind vitality change frameworks. Bidirectional dc-dc converters are needed for applications of twofold side vitality move, for example, vitality stockpiling frameworks including battery, super leading vitality stockpiling frameworks.

Advancement systems based solar board break recognition is investigated. Figure 1. Illustrate the power conversions stages of the tidal energy.

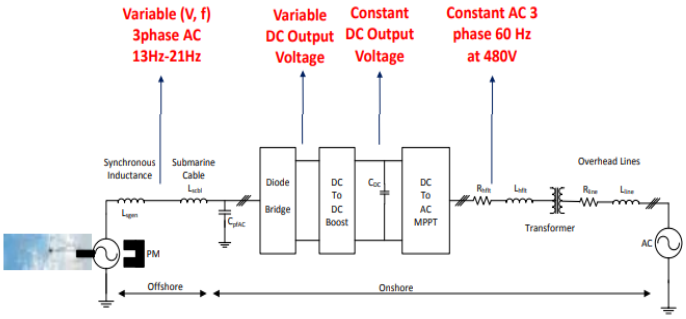

Figure. 1 Tidal Power Conversion Stage

2. Proposed DC-DC Multiport Converter

Figure 2. Shows overall block of proposed DC-DC multiport converter fed from multiple tidal turbine at different altitude coupled with DC generator and PMSG. With multiport converter system the proposed drive can operate with the presence of either of input and the converter is implemented for reliable dc supply.

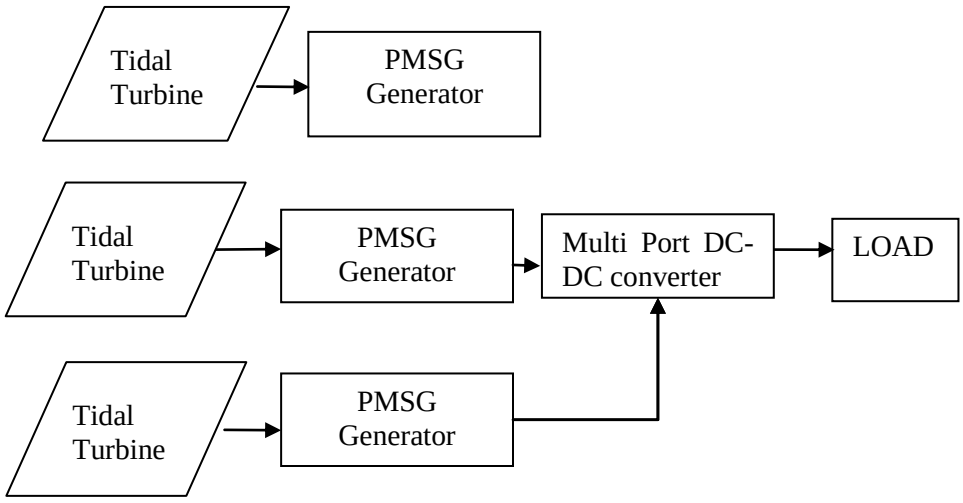

Figure. 1 Tidal Power Generation Block Diagram Based Multiport DC-DC Converter of Proposed System

3. Tidal Turbine

There is increase in use of renewable energy resources due to the shortage of fuels and increase of environment problems. Therefore the tidal energy is utilized in efficient way because of its safe and clean characteristics. Tidal systems are available in the market based on the type of tidal turbine and Permanent Magnet Synchronous Generator (PMSG). Because of its reliability, simple structure and high torque density characteristics the PMSG is widely used. The tidal turbine also plays a vital role in wind power generation. Tidal turbine is shown in figure 3 and PMSG modeling is help for the improvement of efficiency of the power generation in tidal. The tidal turbine converts kinetic power to mechanical power. The mechanical power is given by equation (1),

$$P_{mech} = \frac{1}{2}\prod \rho C_p(\lambda,\beta)Av^3 \qquad (1)$$

Total power obtained from the tidal is represent in below equation (2). Circuit diagram of tidal energy with multiport converter is shown in figure 4.

$$P_{max} = \tfrac{1}{2}\eta\rho Av3$$

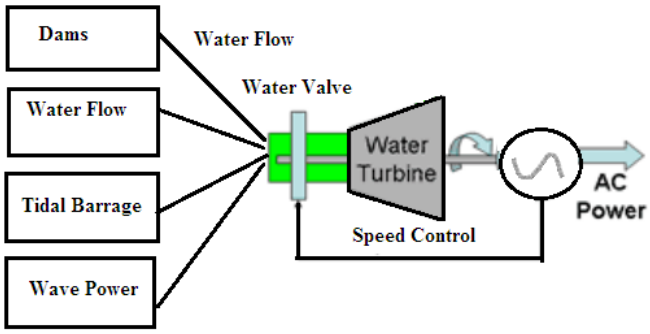

Figure. 3 Block Diagram of Energy Generation from Tidal Source

A PMSG based tidal energy system is used as one more input to multiport system. In PMSG side a power factor corrected single switch three phase boost rectifier is introduced. Figure 5. Shows the circuit diagram of proposed single switch based PFC boost rectifier for PMSG coupled with tidal turbine.

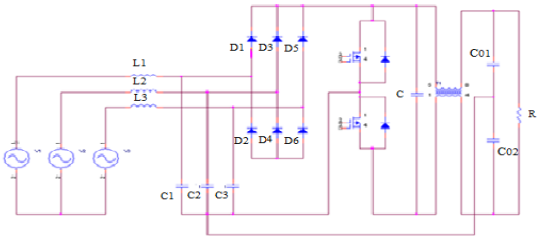

Figure. 4 Circuit Diagram of PFC Rectifier for Tidal Fed PMSG

. Two tidal turbines are fed to a dc generator which is level increased using a normal boost converter. Another tidal turbine coupled with a PMSG is converted to DC using a power factor corrected single switch boost rectifier linked with the dame DC link of multiport converter. The DC-AC inverter interfaces the tidal generator to the framework. The genuine and responsive power is controlled autonomously and momentarily. The DC-AC inverter all in all is controlled to give the collaboration between the tidal generator and the network.

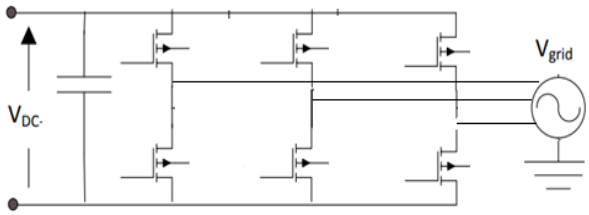

Figure. 5 Grid Connected Inverter Circuit

5. Simulation Results and Discussion

The utilization of DC-DC converter for solar and PMSG wind based proposed system is designed using MATLAB/Simulink as in Figure 6. It shows designed proposed simulation of dc-dc multiport converter. Figure 7. It shows PFC single switch boost rectifier circuit used for wind PMSG. Figure 8 Shows Voltage performance of multiport dc-dc converter proposed system. Figure 9 to 10 shows multiport dc-dc converter that is proposed system performance, single phase PMSG wind output, performance of power factor correction and THD values. The proposed simulation parameters are shown in table 1. That is used in Simulink platform.

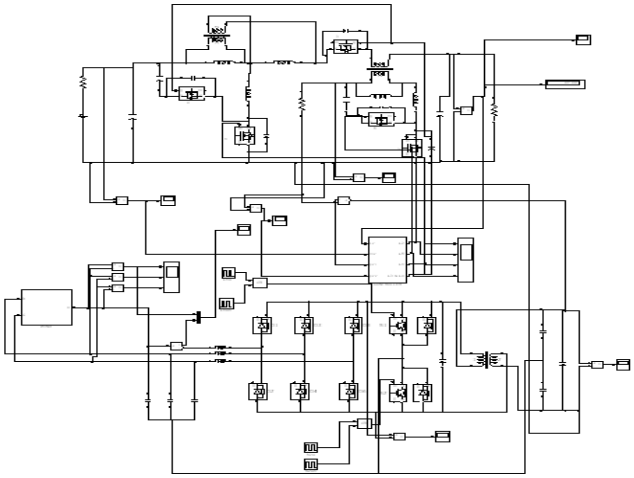

Figure. 6 Proposed Multiport Dc-Dc Converter Simulation

Table1. Simulation Parameters

Resistance Rs	100 ohm
Inductance Ls	120m H
Capacitance ($C_{1,}C_2C_3$)	1uF
Output Capacitor($C_{01,}C_{02}$)	100uF
Load resistor	100 ohms

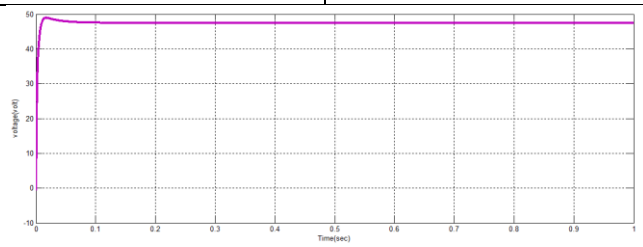

Figure. 7 Voltage Performance of Proposed Tidal Power Generation Fed Multiport Dc-Dc Converter

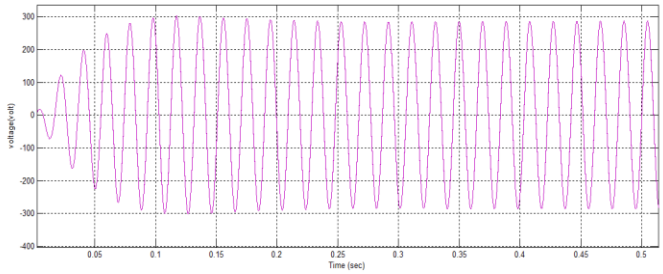

Figure. 8 PMSG Voltage Output of Single Phase

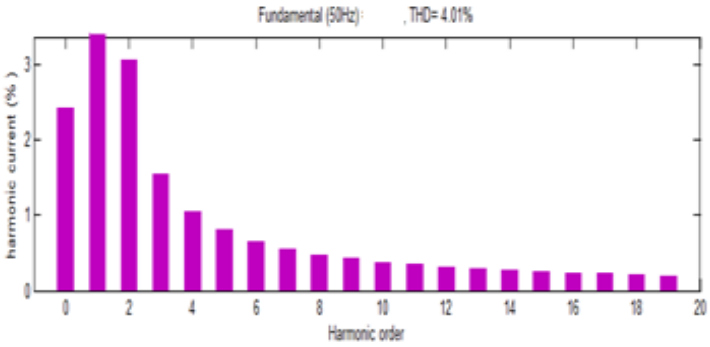

Figure. 9 THD Performance of PMSG

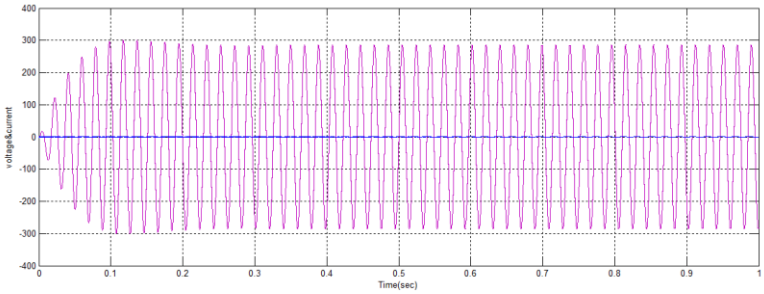

Figure. 10 PFC Using Single Switch Rectifier

7. Conclusion

The basic operation of tidal power generation with multiport converter is presented in this paper. The multi port boost converter and PMSG based single switch power factor corrected

boost rectifier has produced output voltage with high gain and improved power quality performance. The proposed system converter is simulated in MATLAB/Simulink environment and results shows that power factor is high near to unity and THD of the proposed converter is decreased to 4%. Achieved boost ratio of the proposed multi port converter is 1:5 with high power. This converter can be used as a power management device, allocating power to load if generation matches load and if excess power is available store it in some energy storage device.

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