International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

Unity Power Factor Operation Of Indirect Matrix Converter Tied To Unbalanced Grid

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ABSTRACT

This paper presents a full description of the grid-tie Wind Energy Conversion System (WECS) based on interfacing a Permanent Magnet Synchronous Generator (PMSG) to the utility grid by using the direct AC/AC matrix converter.

Due to the random variation of wind velocities, wind speed estimation control technique is used to estimate the wind velocity and extracts the maximum power at all wind velocities.

The matrix converter controls the maximum power point tracking MPPT by adjusting the PMSG terminal frequency, and hence, the shaft speed.

INRODUCTION

In modem electronic power supply distribution systems, there is a sharp rise in the use of single phase and three phase non linear loads such as computer power supplies, commercials, lighting, rectifier equipment. In telecommunication networks, domestic equipments like TV's, oven and adjustable speed drivers (ASD). These non-linear loads generally have solid-state control of electric power and draw non-sinusoidal unbalanced currents from Ac mains resulting in harmonic injection into the supply network through the utility's Point of Common Coupling (PCe). This results in distorted voltage drop across the source impedance, which causes voltage distortion at the pec. Other customers at the same PCC will receive distorted supply voltage, which may cause overheating of power factor correction capacitors, motors, transformers and cables, and mal-operation of some protection devices.

Further, they cause low efficiency, neutral conductor bursting and interface with nearby communication networks. Extensive surveys have been carried out associated with electric power to quantify the problem networks having non-linear loads. Therefore, it is important to install compensating devices to eliminate the harmonic currents produced by the nonlinear loads. Conventionally, loss - less L-C filters are used to reduce hanonicsr and power capacitors are employed to improve the power factor of the AC supply but they have draw

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
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backs of fixed compensation characteristics, resonance and large size.

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EXISTING SYSTEM

This paper proposes an advanced control method of Indirect Matrix Converter operating under unbalanced grid voltages. 1) The converter should provide balanced output voltages and therefore an almost low-frequency-ripple free active power (constant active power) is demanded from the grid.

2) A near unity input power factor operation should be achieved.The proposed method aims to achieve balanced output voltages as well as a near unity input power factor operation. First, an opportune reference current accurately generated, and a proportional integral resonant controller are designed in a dq reference frame that is synchronized with the positive sequence of the grid voltages so as to achieve a perfect tracking of input reactive power reference.

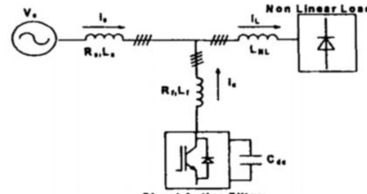
PROPOSED SYSTEM

A full description of the grid-tie Wind Energy Conversion System (WECS) based on interfacing a Permanent Magnet Synchronous Generator (PMSG) to the utility grid by using the direct AC/AC matrix converter. Due to the random variation of wind velocities, wind speed estimation control technique is used to estimate the wind velocity and extracts the maximum power at all wind velocities.

The matrix converter controls the maximum power point tracking MPPT by adjusting the PMSG terminal frequency, and hence, the shaft speed. In addition, the matrix converter controls the grid injected current to be in-phase with the grid voltage for the unity power factor. Space Vector Modulation is used to generate the PWM signals of the matrix converter switches.

BASIC MATHEMATICAL EXPRESSIONS:

The equivalent single-phase representation of the shunt active filter is showed. The compensating current i, is injected to load current h cancel the harmonic current in the source side. Acting as a harmonic trap between load and source, where. R and L are the source impedance resistance and inductance respectively. R, Lc is the AF low pass elements.



: Basic single line diagram of shunt active filter

PROPOSED ALGORITHM:

The reference current drawn from the source is the portion of the current, which retains the same level of distortion as of the voltage, • the same time accounts for the entire fundamental frequent component. The reference current should have the same graphical pattern of variation as the voltage. It might have a time leg or lead, or may be in phase with the voltage, depending on either harmonics only or both harmonics and reactive power compensation capability. Thus, the fundamental frequency component of the reference current will be equal to the fundamental frequency component of the load current (plus loss component, for harmonic compensation, and fur both harmonic and reactive power compensation. All other frequency components will be in the same proportion as their counterparts in the voltage, which can be mathematically expressed as follows.

For harmonic compensation

$$i_s^*(t) = \sum_{n=1}^{k} \left(\frac{I_1}{V_1}\right). V_n . \sin\left(n\omega t + \theta_n + n\left(\Phi_1 -\right.\right.$$

$$I_1 = I_1 + I_{LOSS} \quad \text{for } n=1$$

For harmonic and reactive compensation

$$i_s^*(t) = \sum_{n=1}^{k} \left(\frac{I_1}{V_1}\right). V_n . \sin(n\omega t + \theta_n)$$

$$I_1 = I_1 \cos \Phi_1 + I_{LOSS} \quad \text{for } n=1$$

For the compensation of both harmonics and reactive power simultaneously, both voltage and current should be of similar shape and in phase. Fundamental voltage and fundamental current gives the scaling required for all of the frequency components to estimate the reference current. All of the voltage frequency components are scaled by this factor and rotated by the angle of nth harmonic voltage (i.e., for the 3rd harmonic, for the 5th harmonic, etc.) to obtain the harmonic components of the reference current. The sum of fundamental and harmonic components obtained as per (4) gives the estimated reference current, has the same shape as of the voltage and in phase of it. Since

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
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the shape of the current is the same as of the voltage and is in phase, the reactive power is completely compensated.

POWER CIRCUIT DESIGN:

In order to track the desired source current in an improved order, the value of the low pass filter inductance L, should be made smaller, however a higher switching frequency is required to minimize the line current ripple. Practically, L1 design must be based on the maximum slope of the load current.

$$L_f \leq \frac{\frac{2}{3}V_{dc} - \hat{V}_{xn}}{\max\left|\frac{di_{NLx}}{dt}\right|}$$

Where Vdc is the DC bus nominal voltage, V%II A and i NLx are the peak phase voltage and line load current for phase X. A smoothing reactor is placed in the front end of the non-linear load" to slow down its commutation action, verifying the passive part

CONCLUSION

A grid connected wind energy conversion system for electrical power extraction from wind energy based on PMSG to compensate the shortage of non-renewable energy sources.

In order to extract the maximum available power at each wind speed the excellent tracking of the Maximum Power Point based on wind velocity estimation method is applied. The electrical power generated by the PMG is tied to the grid through a matrix converter, which solve all the problems of the traditional converters.

A new control algorithm for shunt active power filter is proposed .for the compensation of the harmonics and the reactive power. It is able to maintain the same level of distortion in the compensated current to the same level of the distorted voltage source. Thereby, separating the contribution of the customer non-linear load, and forcing this load to behave as a linear load with a unity power factor in most cases. A Full detailed design criterion was presented for the power circuit, DC-capacitor negative charging circuit, as well as the hysteresis controller.

REFRENCES

1 .K.Srinivasan "On separating customer and supply side harmonic contributions", IEEE TranS. Power Delivery. vol II pp 1003-1012 Apr 1996.

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
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2. B. Singh,K.AI·Haddad,and A.Ambrish Chandra."A review ofactivepowerfiltersfor powerquality improvement", IEEETrans.Ind Electron.. vol 46 pO. 1-12.Oct. 1999.

3. A. M. AI-ZBmil and D. A. Torrey,"A passiveseries activeshunt filterfor high