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ModifiedPMSG System using Trans Z Source Network for Grid Connected UPFC System

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***Abstract*: This paper presents a grid connected UPFC system for PMSG wind power network using a Trans Z-source converter. The Trans Z-source converter has a common stage buck boost converter to produce DC voltage from AC input voltage by stabilizing the shoot through state. In the proposed system, the changing in shoot-through state is used to keep trans Z-source voltage regulation with respect to d-q current is capable to take out the more power from the turbine (wind) and fed to grid. The proposed system with UPFC has higherefficiency performanceand cost effectivecompare with conventional Z source PMSG based UPFC system. Matlab simulations are carried out and results prove that proposed system is better.**

Index terms: PMSG,UPFC, TRANS Z SOURCE

I.INTRODUCTION

Conventional Z-source type as produced [1] to complete single-step circuit with buck and boost capabilities. Inside the Z-source network, together with power switches on arm can be exchanged with the equivalent time. A few Z-source converter characteristics in numerous measurements, they are focused on pulse width modulation (PWM) classifications, planning and model applications [2]– [5],[6], [7], Z-source organize strategies [8]– [9]. Trans-Z-sourceinverters were demonstrated to produce the of conventional Z-source inverter, and has positives like as falling in responsive segment and an improvement in the information report. Hardly anyexamination articles has recently focused on upgrading the factor of Z-source converter by applying pulse value to some degree to achieve in the waveform [10]– [11]. Inspite of case, complete boost Z-source type to include capacitors diodes, inductors and Z source impedence gathering to produce an expansive dc-interface voltage from the significant power transformation unit with exceptionally less information dc connect voltage. A blend of Z-source arranges and controlled-inductor structure, called as controlled - inductor Z-source inverter, supply a lift reversal to battle the limitation of conventional Z-source inverter. Successively to beat inrush current issue, which switch ON the controlled-inductor Z-source inverter, a controlled - inductor quasiZ-source inverter are recently coordinated to supplies steady current,limited voltage strain in inductors, capacitors , diodes and lower shoot-through current in alongside the controlled-inductor Z-source type.

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II.CONVENTIONAL TOPOLOGY

The Traditional PMSG based wind topology with conventional Z source control of induction motor is clarified in Fig. 1. Comprise of PMSG which is connected to the rectifier through capacitors, proposed inverter. The reason of the capacitive element(capacitors) is fed to the dc supply and connected to the conventional system [8]. The generator supply given to the Z-source in which organizesthe changes in the speed of the generator with the DC supply.

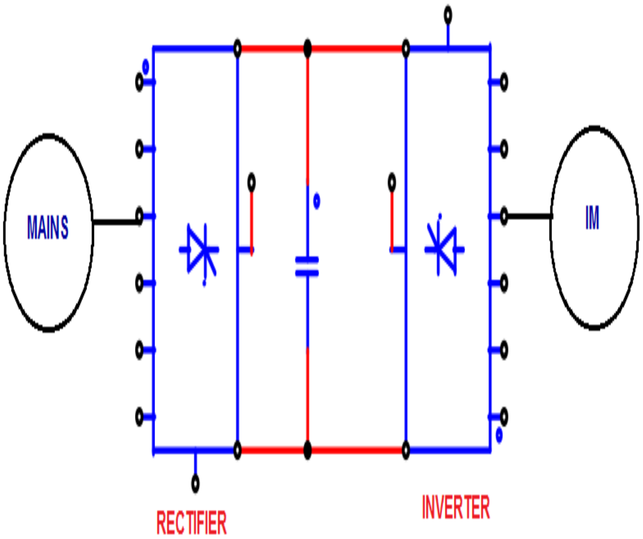


Fig.1 Conventional system to drive IM

The structure of traditional inverter with six switches is clarify in Fig. 2. The traditional system is gathered of capacitors, inductors are developed. The components (L1, L2,C1, C2) has inductive component L' and capacitive component C', correspondingly, thus the conventional inverter is identical. However, conventional inverter have expansion zero vector by expanding the supply is known as shoot-through state and its end association of the load are synchronized with lower and upper parts of stage arm or all arms. In spite of the fact voltage near to the bridge inverter, V1 is voltage get from the rectifier. In boost mode, the maximum dcsupply behind the inverter is named as.

$$V_1 = 2V_1 - Vd_1 = B.V_{dc} \quad \textbf{(1)}$$

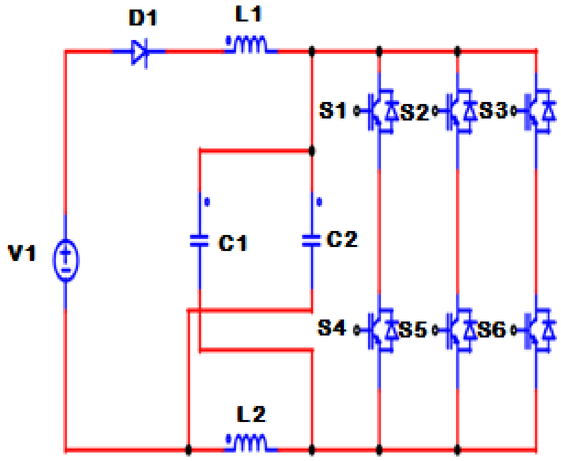


Fig.2 Conventional Z Source Inverter with Six Switches

Line voltage could be exchanged by changing the peak voltage or shoot-through region. The line voltage can be higher shoot through state through [9]. Thus, the voltages of the capacitors are separated with output voltage. Traditional strategy controls are given by

$$V_{SC} = \frac{T-T1}{T} \qquad (2)$$

III.PROPOSED INVERTER TOPOLOGY

The proposed inverters have four switches. They are built from changing the capacitor of the proposed customary inverter as clarify in Fig. 2(c). Itcontains inductor(L1,L2), transformer, capacitors (C1andC2), and diode (D1). The properties of the proposed inverter as: 1) the current;

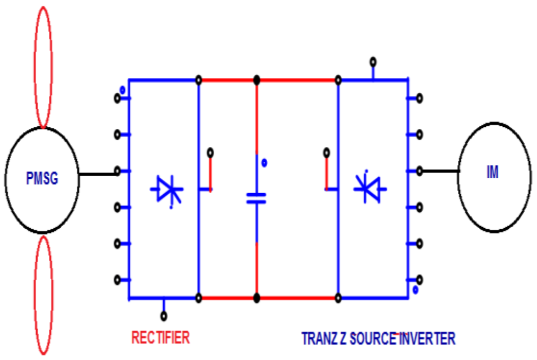


Fig.3 Proposed system with UPFC based LFGWO in PMSG

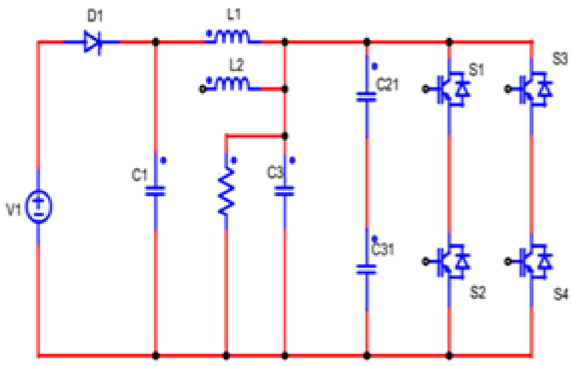
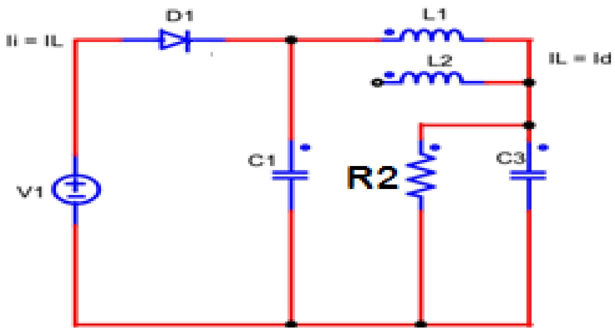
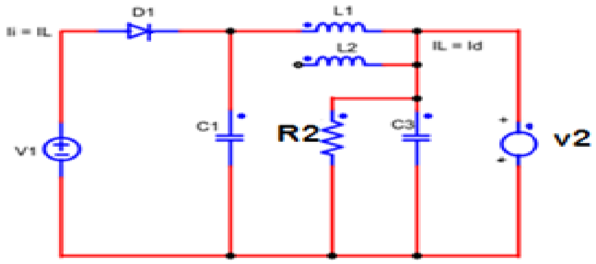


Fig. 4 Proposed Trans Z Source Inverter with Four Switches



(a)



(b)

Fig.5 (a) Equivalent Circuit (b) With continues currentstate

Table.1 Comparison profile in the same e, n, and vd

Eqn	Existing Z source Inverter	Proposed Trans Z source Inverter
PMSG	$V_D = \frac{3\sqrt{2}}{\pi}V_L$	$V_2 = \frac{3\sqrt{2}}{\pi}V_1$
V_f	$V_f = 2V_c - Vd = E.V_d$	$V_{L1} = V_C$ $V_{L2} = NV_C$ $V_2 = V_{L1} + V_{L2}$
E	$E = \frac{T}{T-2T'} \geq 1$	$E = \frac{1}{1-(2+n)D1}$ $E = \frac{1}{1-(2+n)\frac{T'}{T}}$
C	$V_{C1} = \frac{T-T'}{T-2T'}V_D \geq V_D$	$V_{C1} = \frac{1-D1}{1-(2+n)D1}V_1$ $V_{C2} = \frac{(1+n)D1}{1-(2+n)D1}V_1$
L	$V_f = \frac{(T-T')}{T}(2V_{C1} - V_D) = V_{C1}$	$V_{L1} = \frac{-D1}{1-D1}V_1$ $V_{L2} = \frac{-nD1}{1-D1}V_1$

$$V_{L1} = V_1 \quad \textbf{(3)}$$
$$V_{L2} = Nv_1 \quad \textbf{(4)}$$
$$V_2 = V_{L1} + V_{L2} \quad \textbf{(5)}$$

Providing the balance working operation to L1 and L2,(6) and (7) yield.

$$V_{L1} = \frac{-D1}{1-D1}V_1 \qquad \textbf{(6)}$$

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$$V_{L2} = \frac{-nD1}{1-D1} V_1 \quad (7)$$

From (11, 12), we have

$$V_{L2} = \frac{(1+n)D1}{1-D1} V_1 \quad (8)$$

Providing the balance working operation, equation becomes

$$V_{C1} = \frac{1-D1}{1-(2+n)D1} V_1 \quad (9)$$

$$V_{C2} = \frac{(1+n)D1}{1-(2+n)D1} V_1 \quad (10)$$

The proposed inverter E with respect to boost factor is defined by

$$E = \frac{1}{1-(2+n)D1} \quad (11)$$

$$E = \frac{1}{1-(2+n)\frac{T'}{T}} \quad (12)$$

Table.IISymbols and notations

SYMBOL	EXPLANATION
V1	Input voltage
V2	Output voltage
D1	Diode
C1	Charging capacitor 1
C2	Charging capacitor 2
R2	Resistor
L1	Inductor 1
L2	Inductor 2
VC1	Voltage across capacitor 1
VC2	Voltage across capacitor 2
VL1	Voltage across inductor 1
VL2	Voltage across inductor 2
N,n	Number of turns in the inductor coil
E	Boost factor
T	Shoot through time
T1	Initial Shoot through time at t=0

IV.SIMULATON RESULTS

Below waveform indicates that grid three phase voltage and current coming from the bus system1 (generator) with the presence of trans z source with UPFC to reduce the power system disturbance with stability manner , Low THD with respect (LINE VOLTAGE AND CURRENT ,THD VS TIME (SEC) was simulated and output plotted.

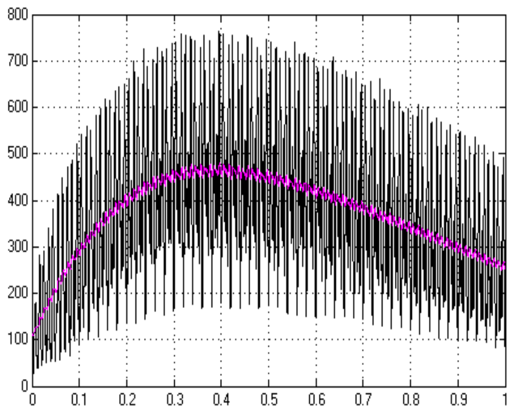

Fig.6 Torque Vs Time in PMSG

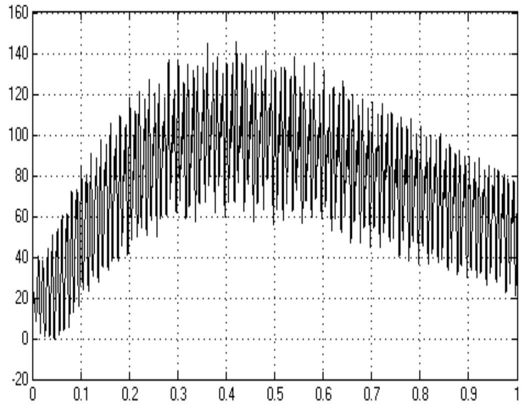

Fig.7 Speed Vs Time in PMSG

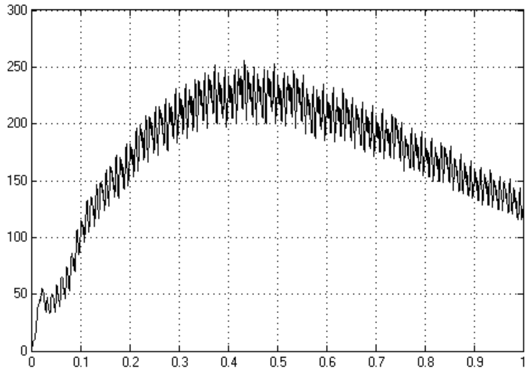

Fig.8 Conventional Inverter Input Voltage

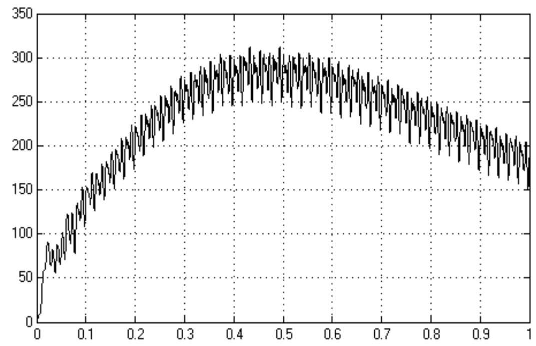

Fig.9 Conventional Inverter Output Voltage

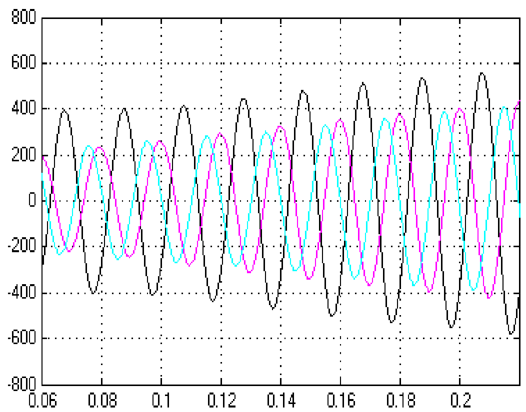

Fig.10 Conventional Inverter Phase Voltage

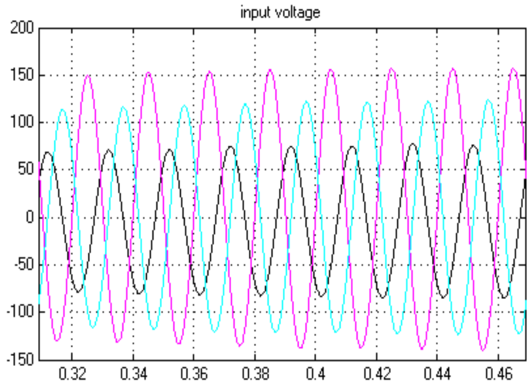

Fig.11 Conventional Inverter Phase Current

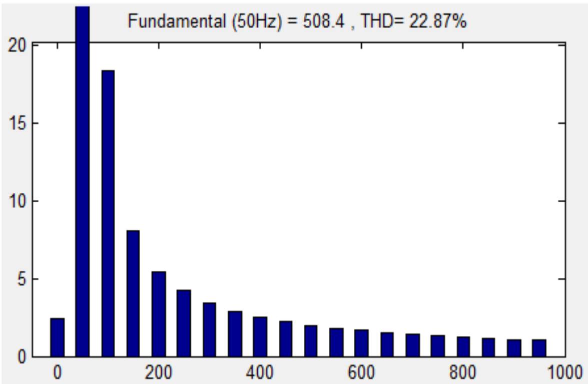

Fig.12 THD in Conventional Inverter

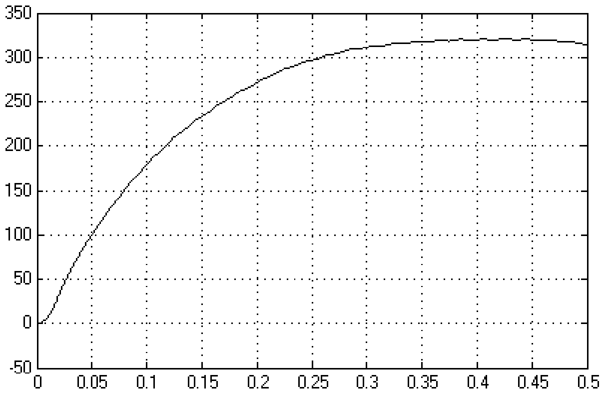

Fig.13 Proposed Inverter Input Voltage

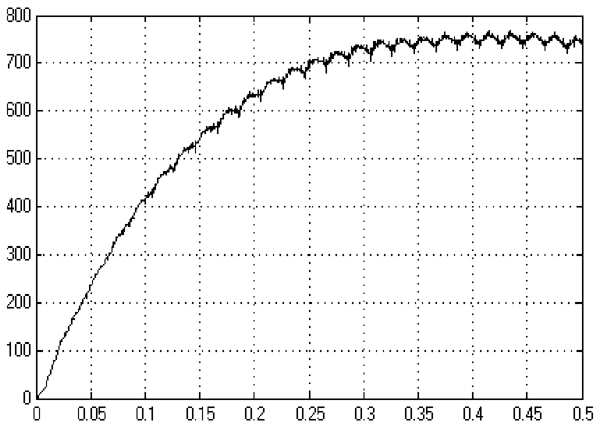

Fig.14 Proposed Inverter Output Voltage

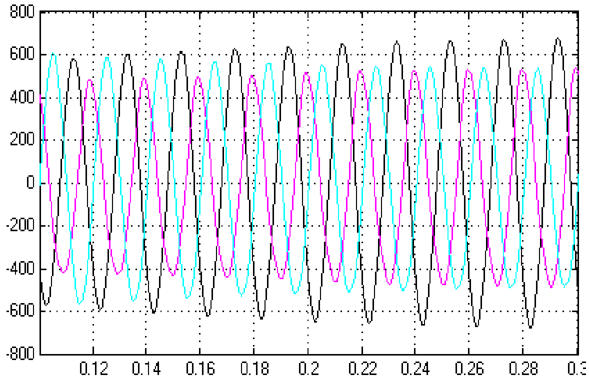

Fig.15 Proposed Inverter Phase Voltage

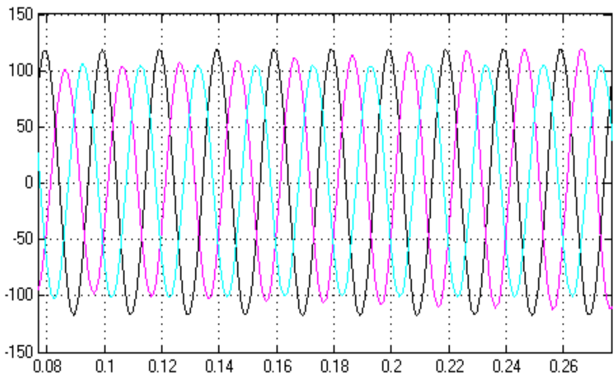

Fig.16 Proposed Inverter Phase Current

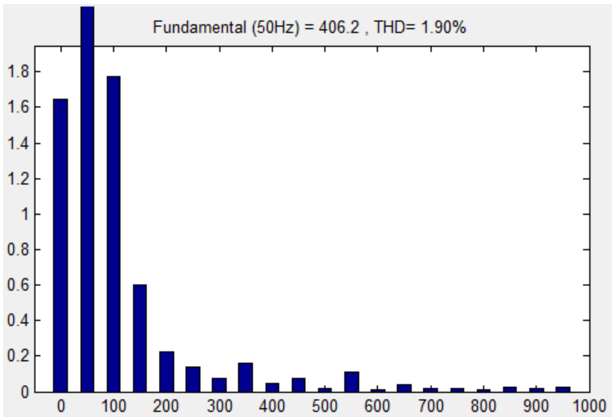

Fig.17 THD in Proposed Inverter

V.CONCLUSION

Novel technique is introduced to enhance the proposed trans-Z-source inverter based UPFC controller the following major properties: large voltage capacity, continuous current control, voltage stability, power control and resonance current control during startup. With respect to classical trans Z-source and trans-quasi-Z-source inverters, for the similar turnover ratio, voltage input and output, the proposed inverter have larger modulation index with minimized voltage strain on the dc link and less current ripple. As a result, prove that proposed methodology has a better efficiency and performance over conventional inverters.

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