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A New Single Phase Shunt Active Power Filter with an Indirect Sensorless Control Strategy

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Abstract:

A single-phase shunt active power filter is used mainly for theelimination of harmonics in single-phase AC networks. In this paper asingle-phase shunt active power filter based on, an indirect controltechnique is designed andsimulated. This control technique isachieved by phase shifting the inputsignal(voltage/current) by π/2.Theoverall action of the shunt active power filter to eliminate theharmonics created by a non-linear load on the source side is discussedin this paper and the output of the shunt active power filter is verifiedusing MATLAB/Simulink software package.

Index Terms: Active power filter (APF), dc–ac converters, implicit control, sensorless control techniques.

I.INTRODUCTION:

Because of the tremendous advantage of power electronic based devices/equipmentthey play a vital role in the modern power processing .As a result thesedevices/ equipment draws non-sinusoidal current from the utility side due to theirnonlinearity .So in addition to the reactive power supply a typical distribution systemhas to take care of the harmonics also[C]. These power quality concerns made thepower engineers to think about the devices which reduces the harmonics in the supplyline [E,F].Such devices are known as active power filter/power conditioners which arecapable of current/voltage harmonic compensation. Active power filters are classifiedinto shunt , series and hybrid active power filters which can deal with various powerquality issues [A,E]. One of the major advantage of the APF's are they are adaptable tochanges in network and load fluctuations and it consumes only less space comparedwith the conventional passive filters[H].

Nowadays power quality issues in single phase system is more than three phase due to the large scale uses of non-linear loads and also due to the increase in newly developed distributed generation systems likesolar photovoltaics,small wind energy systems etc in single phase network[A,G].Reactive power and current harmonics are significant while considering asingle-phasenetwork, which are major concerns for a power distribution system,because these issues leads to other power quality troubles. In thispaper a single-phaseshunt active power filter based on indirect control technique for generating thereference signal is used. In this paper section (2) detailing about single-phase shuntactive power filter, section (3) gives an idea about the indirect control strategy which is then followed by the simulation study and conclusions

II.PRPOSED SYSTEM:

Single-Phase Shunt Active Power Filter:

In this topology the active power filter is connected in parallel to the utility and thenon-linear load.Pulse width modulated voltage source inverters are used in shunt activepower filter and they are acting as a current controlled voltage source.Thecompensation for current harmonics in shunt active power filter is by injecting equaland opposite harmonic compensating current(180 degree phase shifted).As a result theharmonics in line get cancelled out and source current becomes sinusoidal and makes it in phase with source voltage .With the help of control strategies reference signals aregenerated and which then compared with the source current to produce the gatingsignals for the switches.. For the reference signal generation there aredifferentcontrolstrategies like instantaneous active reactive power theory (pqtheory) developed by d-q or synchronous reference frame theory[D]. These control strategies are mainly focused on three phase systems [I].

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The three phase pq theory is made applicable to the single phase systems by the work of Liu [J]by phase shifting an imaginary variable which is similar to voltage or current signalsby 90 degree. Later this concept extended to single phase synchronous d-q referenceframe by Zhang[B].

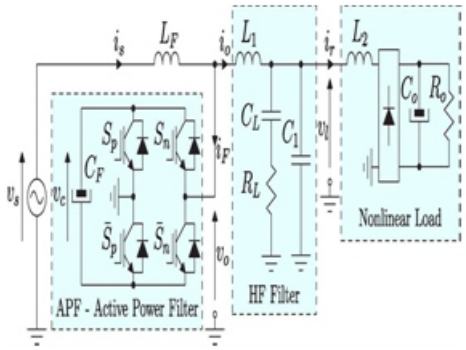
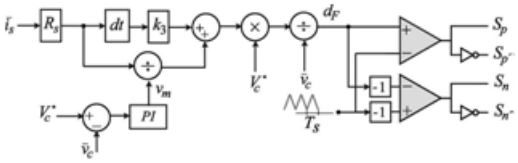


Fig. 1. APF power stage setup

III.CONTROL STRATEGY:

This section presents theoretical analyses regarding the equivalent circuit observed from the mains and the equivalence between the proposed control technique and a control strategy that uses conventional feedback control theory with a resonant controller to obtain close-to-unity power factor. Furthermore, a general stability analysis is presented.



IV. SIMULATION RESULTS:

The simulation results are shown in Figure.

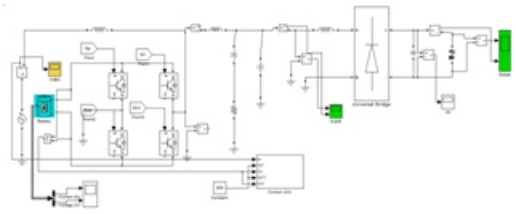


Fig. 2. APF

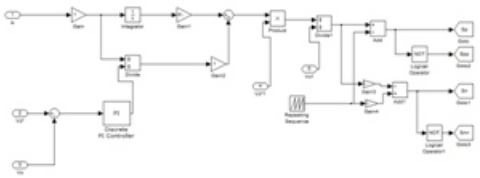


Fig. 3. Control Block.

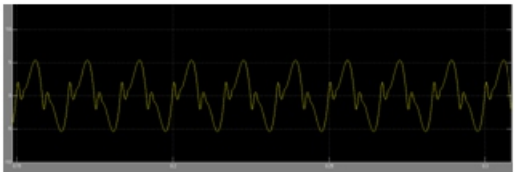
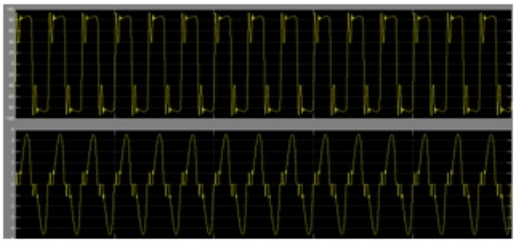
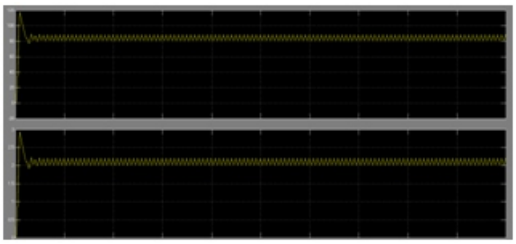


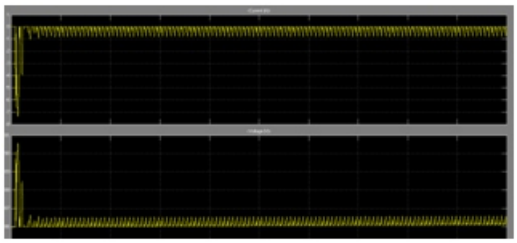
Fig. 4. Source Current.



VL & I0



R-L Load Voltage & Current



Battery current & voltage

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V. CONCLUSION:

A single phase shunt active power filter based on indirect control technique is used in this paper Using this control strategy reference signal is generated successfully.The shunt active power filter is found effective in injecting harmonic compensating current and thereby reducing the source current THD and improves the power factor of the line.The THD is reduced after compensation. It is also noticed that a constant voltage appears across the DC-link capacitor which helps the smooth functioning of the voltage source inverter.The shunt active power filter output is verified successfully with the help of MATLAB software.

REFERENCES:

1]VKhadikar,AChandraandBNSingh(2009),"Generalised single-phasep-qtheoryforactivepowerfiltering:simulation and DSP-based experimentalinvestigation",IET Power Electronics,,Vol.2,No.1,pp.67-78.

[2] R Zhang, M Cardinal, P Szczesny and M Dame(2002), "A grid simulator withcontrol of single-phase power converters in D-Q rotating frame,"inproc.IEEEPower Electronics Specialists Conference(PESC),vol.,pp.1431-1436.

[3] M Gonzalez,V Cardenas and F Pazos(2004),"D-Q transformationdevelopment for single-phase systems to compensate harmonic distortion andreactive power,"inProc. IEEE Power Electronics Congress,pp.177-182.

[4] S Golestan, M Joorabian, H Rastegar, A Roshan and J.M.Guerrero(2009),"Droop based control of parallel-connected single phaseinverters in D-Q rotating frame,"inProc.IEEE Industrial Technology,pp1-6.

[5] B Singh, K Al-Haddad and A Chandra(1999),"A Review of Active PowerFilters for Power Quality Improvement",IEEE Transactions Ind.Electro. vol45,no.5,pp.960-971.

[6]MEl-Habrouk,MK.DarwishandPMehta(2000),"Active power filters areview",inProc. Of IEE-Elect.Power Appl,vol.147,no-5,pp.403-413.

[7] Kunjumuhammed L.P,Mishra M.K(2006) ,"Comparisonof single phase shunt active power filters algorithm",proc.Annu.Conf..IEEE Power India.

[8] Mohammad H Rashid(2007),"Power Electronics Handbook: Devices Circuits and Applications "Elsevier 2e.Single-Phase Shunt Active Power Filter Using Indirect Control Method 89

[9]H Akagi, Y Kanazawad and A Nabae(1984),"Instan taneous reactive powercompensators comprising switching devices without energy storageComponents",IEEE Trans.Ind.Appl,Vol.20.no-3,pp 625-630.

[10] J Liu, J Yang and Z Wang(1999),"A new approach for single –phase harmoniccurrent detecting and its application in a hybrid active power filter,"inproc.Annu.Conf. IEEE.Indist.Electronics.Soc(IECON99),vol 2,pp,849-854.

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