

Solar Power and Wind Power Management System using Power Line Communication

S.P.Vijayaragavan, V.Vijayalakshmi

Abstract: This undertaking proposes Genetic Algorithm based TCSC Compensator in solar-wind based hybrid station for Reactive power administration and transient dependability examination. It likewise intends to choose the setting parameters of TCSC (Thyristor Controlled Series Compensator) controller utilizing Genetic Algorithm (GA) or Genetic Algorithm (GA) to relieve little flag motions. The independent hybrid framework has been re-enacted under various stacking conditions for which an exchange work show has been considered. Effects because of variable load, Wind control input and sunlight based insolation have been contemplated and the definite conduct of the framework has been considered amid typical and blames condition. Reproduction results identified with Reactive power remuneration and voltage steadiness have been ad lobbed with GA or GA.

Index Terms: TCSC, GA, Solar Power and Wind Power, Communication.

I. INTRODUCTION

The request of Alternating Energy has been expanding because of the lack of Conventional vitality sources. Expanded power request because of Industrialization and populace rise has put a weight on wellsprings of age. Ongoing days, Renewable vitality sources are in awesome request, in light of the fact that it is condition neighbourly and less pollute. Numerous spots because of their remote area and non-accessibility of customary vitality sources confront vitality crunch and go for elective vitality ages... Sustainable power sources are the main energies which can be made accessible at remote places and can be given to the remote world. Sustainable power sources like breeze, sun based power module are plenty accessible in the nature yet the fundamental issue being used of sustainable power source is that these are discontinuous in nature. Therefore Researchers have gone for joining at least one sustainable power sources to make a cross breed framework keeping in mind the end goal to confront any exigency that may emerges because of lack of any vitality source whenever. Sustainable power sources like breeze, sunlight based power module are bounty accessible in the nature; however the fundamental issue being used of sustainable power source is that these are discontinuous in nature.

In this manner Researchers have gone for consolidating at least one sustainable power sources to make a cross breed framework with a specific end goal to confront any exigency that may emerges because of lack of any vitality source whenever. Remote crossover control stations are consolidated system with an association of at least one producing sources. In a few places these sustainable sources act independently as well as join with the customary sources to meet the power deficiency and are called Autonomous half breed control framework [1]-[2]. Wind energy change framework has been being used since quite a while and is very much acknowledged in remote and country networks. With the expansion of PV control the mixture framework turns out to be considerably stronger. The mix bridles control from sun, wind and uses the diesel control as a backup. Wind Turbine show is for the most part an Induction engine which is favoured as a result of its powerful qualities and consolidates a synchronous generator based DG. Acceptance generator works with responsive power and has been provided by the Synchronous generator. The measure of receptive power required by Induction generator is met either by Synchronous generator or by both SG and FACTS gadget. In an adjusted circumstance the responsive control is overseen and transient solidness is built up.

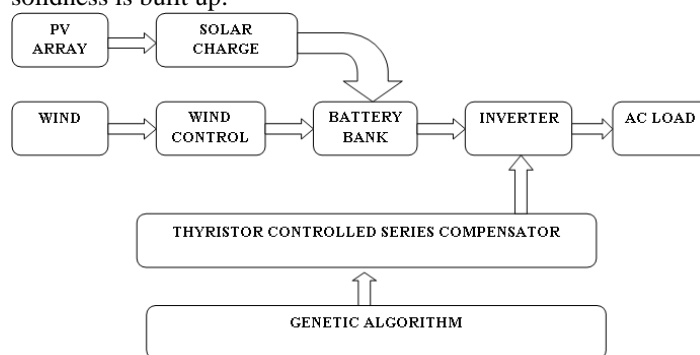


Fig.1. Block Diagram representation of Hybrid wind and solar plant proposed system

II. DESIGN AND IMPLEMENTATION OF PROPOSED SYSTEM

Hybrid frameworks comprise of blend of PV modules and a corresponding technique for power age, for example, a diesel, gas or wind generator. With a specific end goal to streamline the distinctive strategies for power age, half breed frameworks regularly require more advanced controls than remain solitary or lattice associated PV frameworks. Wind Turbine demonstrates is for the most part an Induction engine which is favoured in view of its vigorous attributes.

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The measure of receptive power required by Induction generator is met by FACTS gadget. There is dependably vulnerabilities about breeze information and load input. In this manner settled capacitors are not satisfactory in repaying receptive capacity to the cross breed control framework. Thyristor Controlled Series Compensator (TCSC), an arrangement controlled gadget under FACTS family has been ended up being extremely powerful and viable. Genetic algorithm (GA) is a populace based stochastic advancement procedure. GA imparts numerous likenesses to developmental calculation procedures. The genetic algorithm can address problems of mixed integer programming, where some components are restricted to be integer-valued. The flowchart is represents the genetic algorithm flow which is as shown in the figure 2.

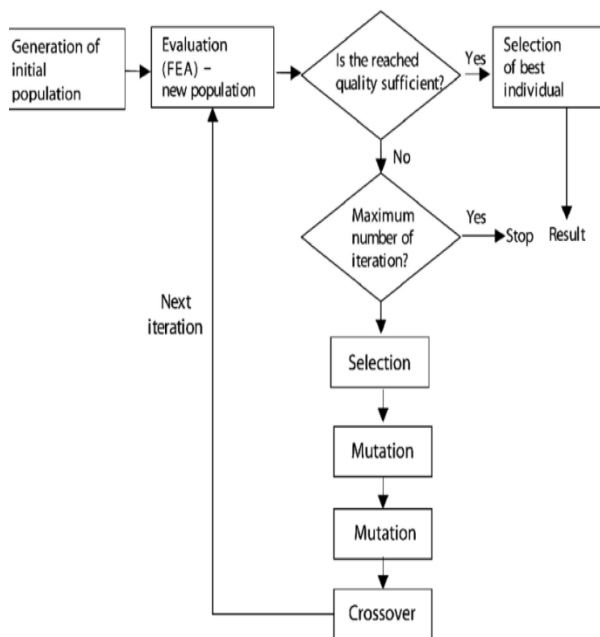


Fig.2. flow chart for Genetic Algorithm

B. Thyristor Controlled Series Compensator

Thyristor-Controlled Series Compensation (TCSC) is employed in power systems to dynamically management the reactance of a transmission line so as to supply decent load compensation. The advantages of TCSC are seen in its ability to manage the number of compensation of a conductor, and in its ability to control in numerous modes. These traits are terribly fascinating since hundreds are perpetually dynamical and can't forever be foreseen.

TCSC styles operate within the same means as mounted Series Compensation; however give variable management of the reactance absorbed by the capacitor device.

C.FACTS

Power gadgets and power quality are unalterably connected together as it endeavours to progress both wide regions. With the sensational increments over the most recent 20 years in vitality transformation frameworks using power electronic gadgets, it is seen that the rise of 'intensity quality' and basic control calculation alteration to this same innovation can frequently assume a similarly predominant job in improving by and large nature of electrical vitality accessible to end-clients. Power hardware has given, as a modern culture, a

plenty of better approaches to make items, give benefits, and use vitality. From a power quality effect perspective, applications, for example,

1. Exchanged mode control supplies,
2. DC bend heaters,
3. Electronic fluorescent light stabilizer,
4. Flexible speed drives, and
5. Adaptable AC transmission parts are frequently caused for concern.

From an utility supply framework perspective, these converter-based frameworks can prompt operational and future issues for other hardware, conceivably not possessed or worked by a similar gathering. It was from this underlying prospect. By and large, similar gadgets and frameworks that make control quality issues can be utilized to take care of intensity quality issues. 'Issue explaining' applications, for example,

1. Dynamic consonant channels,
2. Static and versatile var compensators, and
3. Uninterruptable power supplies

All use indistinguishable changing gadget innovation from the 'issue causing' applications.

As the quantity of possibly hazardous power electronic based loads has expanded after some time, so the consideration is given to improved converter control to augment control quality. Consummate precedents of these changes include:

1. Solidarity control factor converters,
2. Plunge evidence inverters, and
3. Restricted twisting electronic light balances.

While numerous investigations recommend increments in control electronic-based vitality usage as high as 70-80% (of all vitality devoured), it is similarly clear that we are starting to understand the aggregate advantage of such end-utilize advances. Power quality issues related with establishing droops, sounds, and drifters will keep on increasing as a result of the sheer number of touchy electronic burdens anticipated that would be put in benefit.

D.SOLAR PV SYSTEM

The word „photovoltaic “consists of two words: photo, a Greek word for light, and voltaic, which defines the measurement value by which the activity of the electric field is expressed, i.e. the difference of potentials. Photovoltaic systems use cells to convert sunlight into electricity.

E.WIND POWER GENERATION SYSTEM

Research about powerful models for lattice associated wind vitality change frameworks is one of the difficulties to accomplish information for the progressing change because of the escalation of utilizing wind vitality in these days. This book section is a contribution on those models, however managing wind vitality change frameworks comprising of twist turbines with lasting magnet synchronous generators (PMSG) and full-control converters. Especially, the centre is on models coordinating the dynamic of the framework as much as possibly vital all together to declare results on the activity of framework.



In demonstrating the vitality caught from the breeze by the cutting edges, aggravation forced by the asymmetry in the turbine, the vortex tower cooperation, and the mechanical Eigen swings in the sharp edges are acquainted all together with affirm a more precise conduct of wind vitality transformation frameworks. The change framework dynamic comes up from demonstrating the dynamic conduct because of the primary subsystems of this framework: the variable speed wind turbine, the mechanical drive prepare, and the PMSG and power electronic converters. The mechanical drive prepare dynamic is considered by three distinctive model methodologies, individually, one mass, two-mass or three-mass model methodologies with a specific end goal to talk about which of the approaches are more appropriated in confining the conduct of the framework. The power electronic converters are displayed for three distinct topologies, separately, two-level, staggered or framework converters. The thought of these topologies is so as to uncover its specific conduct and points of interest in what respects the aggregate consonant mutilation of the current infused in the electric system. The electric system is displayed by a circuit comprising in a progression of an opposition and inductance with a voltage source, individually, thinking about two theories: without consonant contortion or with bending because of the third symphonies, keeping in mind the end goal to demonstrate the impact of this third consonant in the converter yield electric current. Two kinds of control procedures are considered in the dynamic models of this book part, separately, using established control or partial request control. Contextual investigations were composed down with a specific end goal to underline the capacity of the models to re-enact new commitments for contemplates on lattice associated wind vitality transformation frameworks.

F. BOOST CONVERTER

Figure 1 demonstrates disentangled forms of both the lift and buck converters. Just the power organize is appeared; an entire controller requires more hardware to manage the yield. We will begin by taking a gander at the buck. Note that one side of the inductor is associated with the yield hub. Since no DC current can move through the yield capacitor, the whole load current moves through the inductor. The opposite side of the inductor is associated with the basic hub between the MOSFET and diode. Figure 2 demonstrates the inductor and MOSFET current in CCM. On the off chance that we disregard the little triangular swell, it is anything but difficult to see that the pinnacle MOSFET current is almost the same as the heap current. This makes it simple for the controller maker to determine the most extreme load current that the controller can supply. Despite the info or yield voltage, the MOSFET can be measured for the greatest load current. Likewise, as far as possible can be set simply over this most extreme esteem. Thus, the most extreme MOSFET current rating of a buck is the greatest load current rating. For instance the LM43603 is evaluated for 3A on the information sheet. This is the most extreme load current for this gadget.

This isn't the situation for a lift converter. Note from Figure 1 that the inductor is associated from the info supply to the regular hub between the MOSFET and diode. In this manner the pinnacle MOSFET current is presently almost equivalent

to the information current, not the heap current. We will see without further ado that the info current relies upon the information and yield voltages of the converter. The lift controller is still evaluated in light of the most extreme MOSFET current yet this does not speak to the greatest load current, similarly as with the buck.

G. INVERTER

The 3-stage connect type VSI with square wave shaft voltages has been considered. The yield from this inverter is to be bolstered to a 3-stage adjusted load. Inverter 24 Voltage and Current Ratings of Inverter Switches.

As in a solitary stage square-wave inverter, switches in every leg of the three-stage inverter work in a correlative way. At the point when upper switch of a leg is on the lower change should hinder the whole dc transport voltage and the other way around. Hence the switches must be appraised to obstruct the most pessimistic scenario momentary extent of dc transport voltage. Henceforth the switches must be appraised to withstand the pinnacle expected greatness of momentary load-stage current. For a non-solidarity control factor stack, the diode associated in hostile to parallel with the switch will lead some portion of the switch current. The circulation of current between the diode and the controlled switch will rely upon the heap control factor at the working recurrence. By and large both diode and the controlled switch ought to be appraised to convey the pinnacle stack current. These diodes additionally need to hinder a pinnacle turn around voltage equivalent to most pessimistic scenario voltage over the switches.

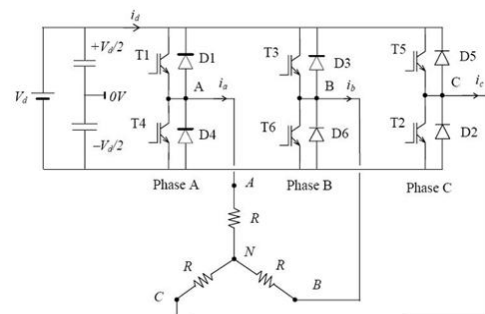


Fig.7. Three phase inverter

Restrictions of 3-Phase Square Wave Inverter: The three-stage square wave inverter as depicted above can be utilized to create adjusted three-stage air conditioning voltages of wanted (key) recurrence.

The info dc voltage to the inverter is frequently gotten from an air conditioner source after amendment and sifting. A basic diode connect rectifier taken after by a channel capacitor is regularly the most practical strategy to get dc voltage from air conditioning supply. In a few applications, as in un-interfered with control supplies, the dc info might originate from a bank of batteries. In both these precedents, the info dc size is genuinely steady. With settled info dc voltage the square-wave inverter can yield just settled extent of load voltage. This does not suit the necessity as a rule where the heap requires a variable voltage variable recurrence (VVVF) supply.

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All together that air conditioner yield voltage size is controllable; the inverter input voltage should be shifted utilizing an extra dc-to-dc converter. Anyway a superior arrangement will be to utilize a PWM inverter which can furnish a VVVF yield with improved yield voltage quality. Despite the confinements, talked about over, the square wave inverter might be a favoured decision by virtue of its straightforwardness and ease. The switch control circuit is extremely basic and the exchanging recurrence is essentially lower than in PWM inverters.

The switch cost may likewise be lower as one may get rid of slower exchanging gadgets and somewhat bring down appraised switches. Another preferred standpoint over PWM inverter is its capacity to yield higher size of major voltage than the most extreme that can be yield from a PWM inverter.

Utilizations of a 3-stage square wave inverter

(I) A minimal effort strong state recurrence changer circuit: This circuit changes over the 3-stage air conditioning (input) voltages of one recurrence to 3-stage air conditioning (yield) voltages of the coveted recurrence. The information air conditioning is first changed over into dc and after that changed over back to air conditioning of new recurrence. The square wave inverter examined in this exercise might be utilized for dc to air conditioning transformation. Such a circuit may, for instance, convert 3-stage air conditioning voltages of 50 Hz to 3-stage air conditioning voltages of 60 Hz. The contribution to this circuit could also have originated from a solitary stage supply, in which case the single-stage air conditioning is first changed over into dc and afterward changed over back to 3-stage air conditioning of the coveted recurrence.

(ii) A continuous power supply circuit: Uninterrupted power supply circuits are utilized to give continuous capacity to some basic load. Here a basic load requiring 3-stage air conditioning supply of settled extent and recurrence has been considered. On the off chance that air conditioner mains supply comes up short, the 3-stage load might be electronically exchanged, inside couple of milliseconds, to the yield of the 3-stage square wave inverter. Info dc supply of the inverter frequently originates from a battery bank.

H. Grid Integration

Administrators of RE age plants may utilize vitality capacity innovations to aid the reconciliation of a specific plant, or of a few plants that feed into a similar substation. Utilizing the phrasing of segment 4, EES utilized in this form serves to move forward the framework amicability of RE age itself. It is imperative to comprehend that age side utilize of vitality stockpiling isn't just a move in possession of the capacity asset, however an altogether unique job for capacity from that imagined by lattice side utilization of EES. As opposed to utilizing EES as an apparatus to adjust a whole power lattice, a RE age plant may utilize EES to give coordination applications preceding framework mix, either at the plant or substation level. While the specialized prerequisites of age side EES applications are like those of framework side EES, more noteworthy flexibility is required of age side EES offices, in light of the fact that a solitary RE plant shows more noteworthy fluctuation and vulnerability

than numerous RE plants amassed on the same matrix. This implies devoting EES offices to specific RE age results in proportionately higher expenses than utilizing EES to adjust net fluctuation and vulnerability on the framework. For disconnected also, geologically obliged frameworks, be that as it may, co-area of RE age and EES might be an appealing choice, as adjusting such lattices through interregional exchanging, customary reinforcement limit or on the other hand request side administration is additionally testing than for bigger and more interconnected lattices.

Basically, age side utilization of EES expects to change a wildly factor and incompletely capricious asset into a controlled and unsurprising one – it transforms RE age into something that looks particularly like traditional vitality age. Such a RE age asset is said to be dispatch able. It might likewise assume a job.

III. SIMULATION OF PROPOSED SYSTEM

The proposed technique is implemented in MATLAB simulation software. The simulated model is as shown in the figure 3.

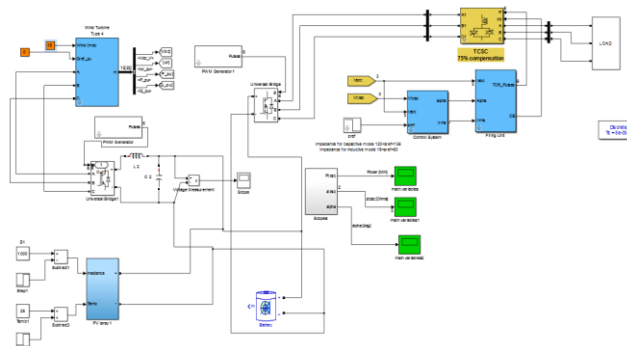


Fig.3.Simulation model of hybrid system

The proposed system has solar and wind hybridized is as shown in the figure 4 and 5 respectively.

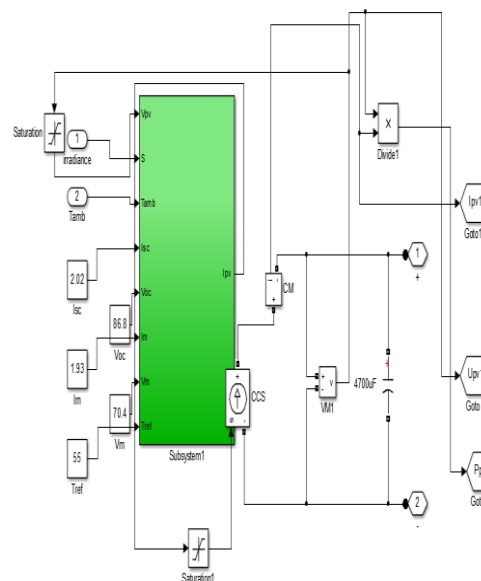


Fig.4.Simulation Model of Solar PV power generation

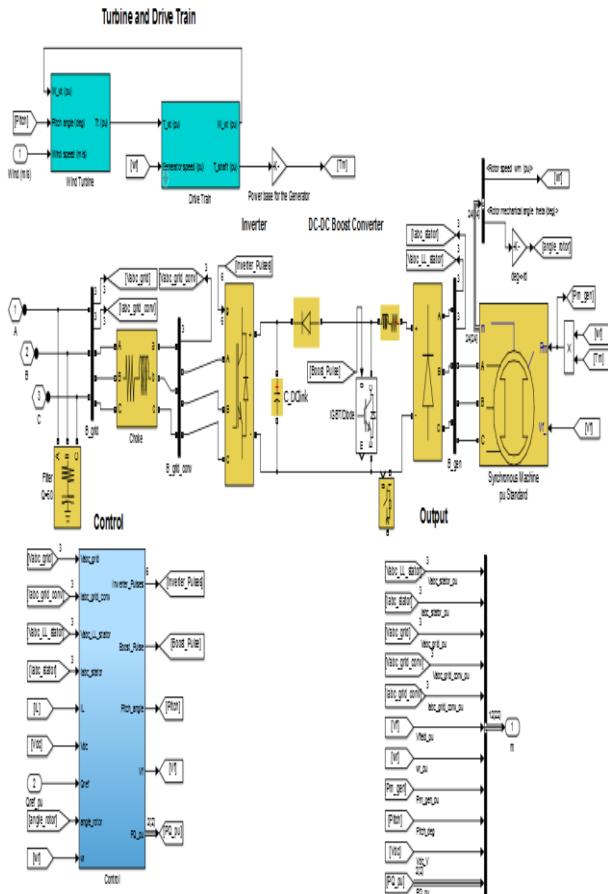


Fig.5.Simulation model Wind power generation system

The TCSC connected to the grid is also simulated in the MATLAB/Simulation software. The simulation model of TCSC is as Shown in the figure 6.

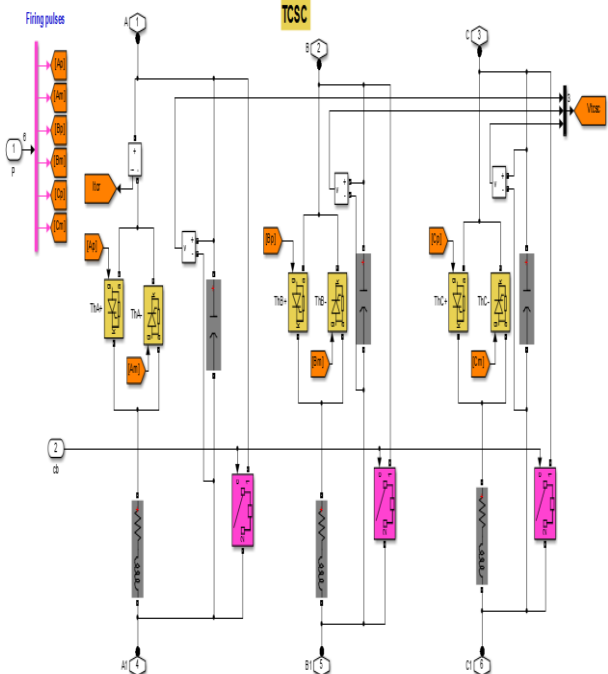


Fig.6.Simulation model of TCSC connection

The proposed TCSC is connected to the grid and the control parameters are used to construct the reactive power compensation. The proposed control system is as shown in the figure 7.

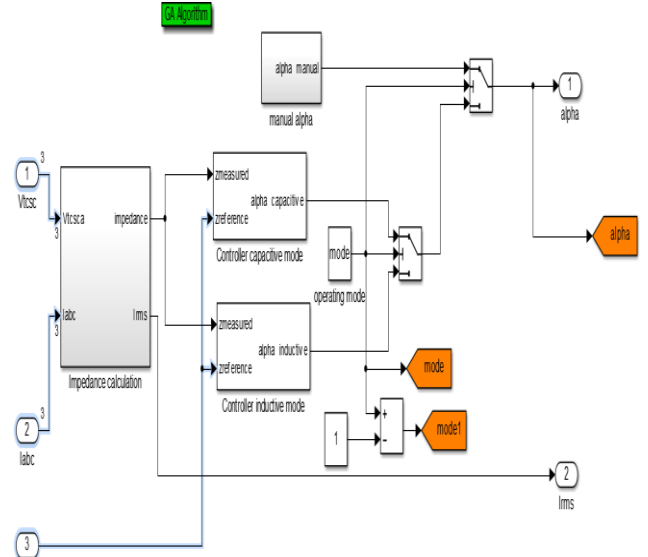


Fig.7. control methodology of proposed system

IV. SIMULATION OUTPUT AND RESULTS OF PROPOSED SYSTEM

The above proposed system is simulated with the IJR control topology used. Figure 8 represents the grid power during the TCSC operation from the figure it is clear that the power is restored to 3 kw since the introduction of TCSC.

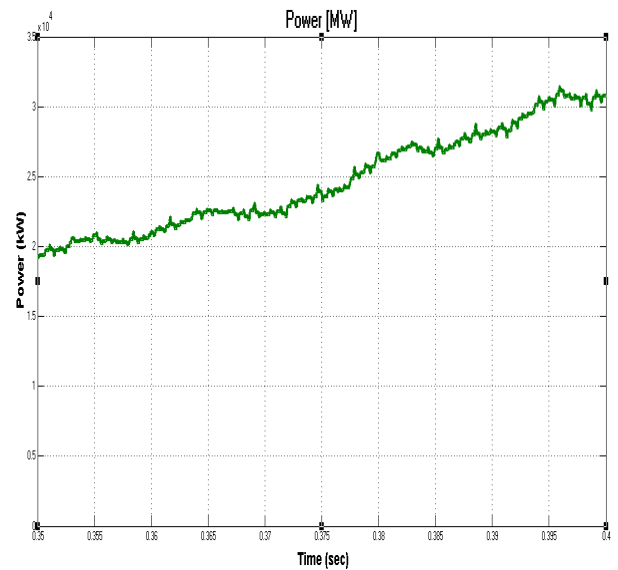


Fig.8.Power output waveform of grid connected hybrid system

The impedance of line and grid is calculated to give control for firing angle in TCSC component semiconductor switch when the disturbance occurs the firing angle is given. That's when the actual is different from measured as shown in the figure 9. When there is no reactive power required then the angle comes to 90. That is when there is no difference in actual and measured impedance.

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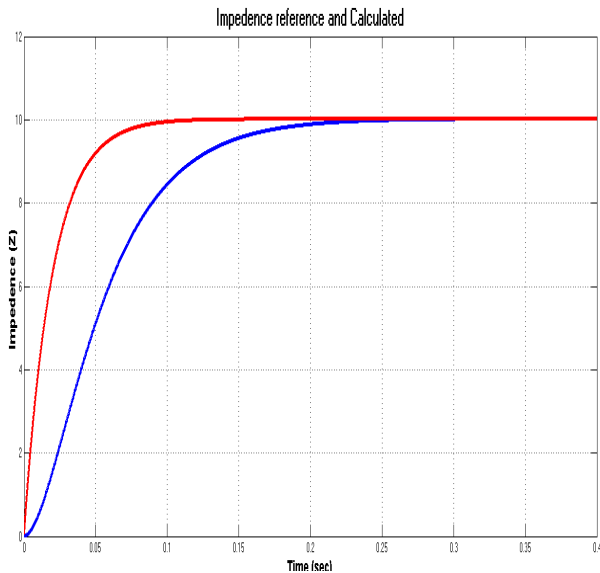


Fig.9. Actual and measured impedance

The firing pulse given to TCSC is called the alpha angle which is as shown in the figure.10.

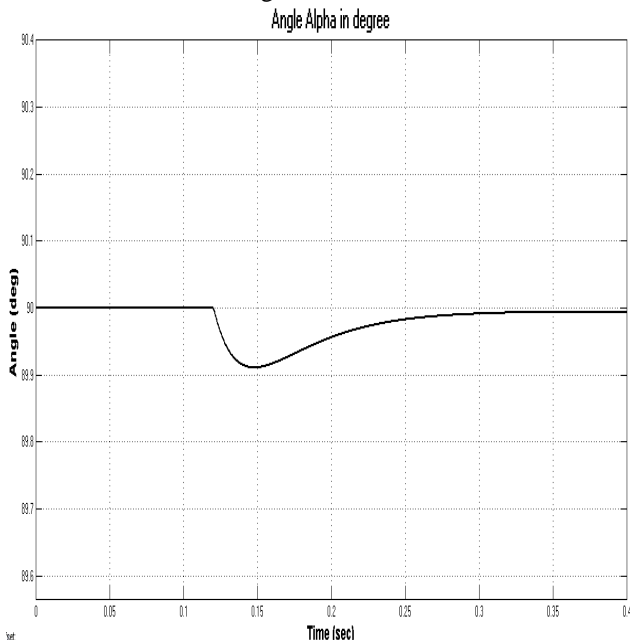


Fig.10.Firing angle Alpha Waveform

From the above figure the disturbance where the angel gets reduced and restored to normal value.

Quantitative Approach Improvement:

MW Generation	power	Ztcsc compensation time (sec)	Alpha Variation in (deg)
3 MW		0.25 s	89.9
4 MW		0.29 s	88
5 MW		0.31 s	88.2
5.5 MW		0.33 s	87.5

V. CONCLUSION

A system designed consisting of hybrid solar and wind connected to grid accompanied with in controlled reactive power grid using proposed Genetic algorithm. The hybrid wind and solar generates an uncompensated output which is connected to grid the output in grid is connected is enhanced

with the reactive power using proposed genetic algorithm. Thus with the help of MATLAB simulation software the proposed technique is implemented and designed. The output waveform generated clearly explains that the compensation is enhanced at the graph where the reference impedance is equalled to measured impedance of the grid system.

REFERENCES

1. E.Ian Baring-Gould“Wind Diesel Power SystemsBasics and Examples”National Renewable EnergyLaboratory, United States Department of Energy
2. J.Kaldellis et al,“Autonomous energy system forremote island based on renewable energy sources”,inproceeding of EWEC 99,Nice.
3. T.K.Saha, D.Kasta,“Design optimisation& dynamic performance analysis of electrical power generation system”IEEE Transaction on Energy Conversion Device, 2010.
4. R.C Bansal,“Three phase self-excitedInductiongenerators, an overview”,IEEE Transaction on Energy Conversion,2005.
5. SS Murthy, OP Malik and AK Tondon, “Analysis of Self Excited Induction Generator” IEE Proceeding, vol 129, Nov 1982.
6. KRPadiyar,“FACTS Controlling in PowerTransmission system and Distribution”,New A ge International Publishers , 2008 .
7. R C Bansal“Automatic Reactive Power Control ofAutonomous Hybrid Power System “PhD Thesis, Centre for Energy Studies, IIT Delhi December 2002.
8. M. O. Hassan, Z. A. Zakaria and S.J. Cheng, “Impact of TCSC on enhancing power system stability,” in Proc. APPEEC 2009, IEEE Power and Energy Conference, pp. 1-6.
9. Vijayaragavan, SP; Karthik, B; Kiran Kumar, TVU; , A DFIG based wind generation system with unbalanced stator and grid condition, Middle-East Journal of Scientific Research, V-20, I-8, pp-913-917, 2014.
10. Vijayaragavan, SP; Pati, Debasish; Karthik, B; Design and Implementation of a Photovoltaic Energy Management System with Battery Backup, Programmable Device Circuits and Systems, V-6, I-7, pp-197-199, 2014.
11. Vijayaragavan, SP; Karthik, B; Kiran Kumar, TVU; Sundar Raj, M; , Analysis of chaotic DC-DC converter using wavelet transform, Middle-East Journal of Scientific Research, V-16, I-12, pp-1813-9, 2013.