An Modified Renewable Energy Integration System with Motor Generator Pair Using Fuzzy Logic Controller

Dr.R. Sankarganesh and A. Selvakumar

Abstract--- The Motor-generator Pair for Renewable Energy Integration synchronous generator, converters do not have inherent inertia which is important for frequency response. More complex interaction induced by renewable energies cause's problems of power system dynamics, for example, damping oscillation. In addition, converters cannot support high fault current, leading to a limitation of some existing control schemes during transient events. However, compared with converters, the synchronous generator has some advantages to solve the problems mentioned above. Therefore, this study proposes a synchronous motor-generator pair (MGP) system as a possible grid-connection way for high penetration of renewable energies to improve stability.

Keywords---- Wind Turbine, Solar, Dc/Dc Converter, Fuzzy, Dc Bus, Load.

I. INTRODUCTION

The wind and solar oriented photovoltaic (PV) had record increments for the second back to the following year, representing new establishments. The Penetration rate of more than significantly higher has shown up in a few nations and locale. Be that as it may, the high infiltration rate of sustainable power sources likewise conveys testing consistent quality and security issues to the power network. One noteworthy test is recurrence unsteadiness prompted by substitution of the synchronous generator. The Rotor speed of the synchronous generator is firmly combined with system recurrence subsequently its snapshot of latency can be removed to help recurrence deviation. Be that as it may, sustainable power sources, for the most part, can't give enough inertia. For instance, doubly fed induction generator (DFIG) just has constrained dormancy reaction, the rotor speed of the lasting magnet synchronous generator is decoupled with lattice recurrence, and its inactivity reaction does not in any case exist, and besides, sun-oriented PV. As a rule, they work with the most extreme power point following mode henceforth the dynamic power collaboration with framework relies upon change, prompting absence of enough idleness vitality when important. A second significant test is the multifaceted nature of intensity power progression. With more sustainable power sources being associated with the network, the many-sided quality is likewise expanding a direct result of non-linearity and numerous different components including vacillation, distinctive breeze turbines, control techniques and parameters, entrance rate and working district. This will cause vulnerability of dynamic communication between the sustainable power source and power stream. A standout amongst the most concerns is damping control. Lately, some power wavering occasions have been seen in wind ranches comprising. Henceforth it is important to enhance damping capacity for control matrix with the high entrance of a sustainable power source. Lots of dormancy and damping control strategies

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accomplished by converter have been proposed to take care of previously mentioned issues. A control technique called virtual dormancy or virtual synchronous generator is expected to influence sustainable power sources to have comparable ways like a synchronous generator to upgrade soundness. For wind control, the dynamic vitality of the rotor can be discharged to help lattice recurrence and clammy wavering. For PV, a helper vitality stockpiling framework is utilized to accomplish enough power cooperation with the grid. Some assistant damping controllers are additionally intended for twist turbines to improve damping. In any case, it is constantly troublesome for them to perform well truth be told. The converter cannot help high short out current when huge, unsettling influence occasions happen. Consequently, its over-burden and transient voltage supporting capacities are not in the same class as a synchronous generator. Change and some particular task modes, and also cost concerns additionally make it troublesome for sustainable power sources to give enough capacity to the dynamic procedure. It can be seen obviously from the above discussion that synchronous generator being gradually replaced by renewable energy sources makes the future grid a configuration dominated by converters, which may lose some good characteristics of the traditional power source. A highly-reliable power network with large-scale penetration of distributed renewable resources. Moreover, some exploration has likewise attempted to reuse resigned generator as a synchronous condenser to enhance framework solidness for recurrence reaction as well as short out execution. Consequently, in light of the way that synchronous machine and Synchronization are noteworthy for lattice dependability, this paper proposes a conceivable arrangement, synchronous engine generator match (MGP) framework, to settle steadiness issues. The power created by the sustainable power source is utilized to drive a synchronous engine, which works as an essential mover of the synchronous generator. The generator is then associated with the lattice. With the end goal of network strength, it is important to ponder this unique double synchronous machine framework from control framework perspective.

II. LITERATURE REVIEW

The Energy Electricity generated from renewable energy sources (RES) is deemed to be one key element in the transition towards a low carbon energy system. However, many RES technologies, such as wind or photovoltaic (PV), are intermittent and volatile, which raises the importance of balancing markets as a source of providing flexibility to the system. In practice, the standard approach to procure balancing capacity is a static one, which means that the reserved balancing capacity is constant over a certain period (e.g., one year). This causes costs for the Transmission System Operator (TSO) and therefore via different channels ultimately for the final consumer, even if reserved capacity is not fully used. We apply machine learning algorithms to predict required balancing reserve capacity for the next day in the Austrian electricity market. This dynamic approach yields reserve capacities, which are different for every quarter hour and eventually depend on the amount of seasonal renewable forecasts, load forecasts, their gradients, calendar and time effects, which lead to lower costs. The Reserve capacity for the next day in the Austrian electricity market. This dynamic approach yields reserve capacities, which are different for every quarter hour and eventually depend on the amount of intermittent renewable forecasts, load forecasts, their gradients, calendar and time effects, which lead to lower costs. Prediction level and the procurement of the future. Many references are made to the Graf-Haubrich-procedure. In this method, a density function for each input parameter is calculated. These density functions are convoluted together assuming stochastic independence of the parameters. Similar methods are indicated. Whereas static procedures take longer time horizons into account to predict the future demand for reserve capacity, dynamic procedures deal with shorter time frames. The static approach is not optimal for the RES integration process

since its stable procurement of reserves independent of predicted feed-in together with a "worst case determination" tends to cause the reservation of overcapacities, while RES lead to high deviation peaks within minutes. The problem in dynamic modeling of balancing capacity is that the main influence parameters like wind forecast errors or PV forecast errors are only known or significantly reduced in or close to real time and hence cannot be used as input variables for the day-ahead (DA) model. The Renewable vitality turns into a key supporter of our advanced society, however, their reconciliation to control grid noteworthy specialized difficulties. Power quality is an imperative part of sustainable power source coordination. The real power quality concerns are Voltage and recurrence vacillations, which are caused by non-controllable changeability of sustainable power source assets. The irregular idea of sustainable power source assets due to regularly changing climate conditions prompts voltage and recurrence vacillations at the interconnected power grid. Harmonics, which are introduced by power electronic devices utilized in renewable energy generation. At the point when the entrance level of the sustainable power source is high, the impact of music could be huge. The extensive literature review is conducted on emerging power quality challenges due to renewable energy integration. The consists of two sections: Power quality problem definition. Wind turbines and solar photovoltaic (PV) systems and their power quality issues are summarized. Existing approaches to improve power quality. Various methods are reviewed, and the control technology based power quality improvement is the major focus. The future research directions for emerging power quality challenges for renewable energy integration are recommended. Renewable energy such as wind turbines and solar photovoltaic (PV) systems use natural resources and provide desirable green energy. The penetration of renewable energy is increasing worldwide. The advancement in renewable energy is exciting but also creates significant technical challenges to power industry our traditional power generation system is designed with large, centrally controlled power plants. Renewable energy, however, is distributed, independently controlled, and intermittent. Therefore, adapting the power grid to operate reliably with renewable energy sources can be very complicated. How to increase flexibility and reliability, improve energy efficiency and power quality for tomorrow's smart grid are important considering the huge potential investment over next decades on maintaining and expanding power grid to accommodate renewable energy generation. It was recognized that grid-connected renewable power generation would introduce power quality issues to the power grid. From renewable energy side, renewable generation is non-dispatch able, and intermittent with high fluctuations due to the varying nature of renewable energy resources. As the penetration level of renewable generation increases over time, such high fluctuations create serious power quality concerns. From power grid side, the grid side disturbances, such as voltage sags caused by short circuit faults and frequency variations due to load and generation change, would interact with the interconnected renewable energy sources, which create more complicated and uncertain operating conditions.

III. PROPOSED ARCHITECTURE

The MGP, a grid-connection way based on synchronous machines for renewable energy sources are proposed as a possible solution to provide inertia and damping for the future power grid. Sum of rotor angle of each machine is regarded as an equivalent rotor angle of MGP to establish state equations, and experiment verifies its characteristic. Compared with the model of traditional generator, the results indicate that with the same capacity, inertia constant of MGP accounts for more than thermal power unit and it's damping ratio and times the traditional one. Time reaction of little aggravation and transient occasions demonstrates that MGP can viably clammy rotor edge wavering and point of confinement the rate of progress of recurrence and be utilizing the energy unit actualized the power voltage vector created from the present control circle is sent to the space

vector move balance to control the dynamic power utilizing the fuzzy controller.

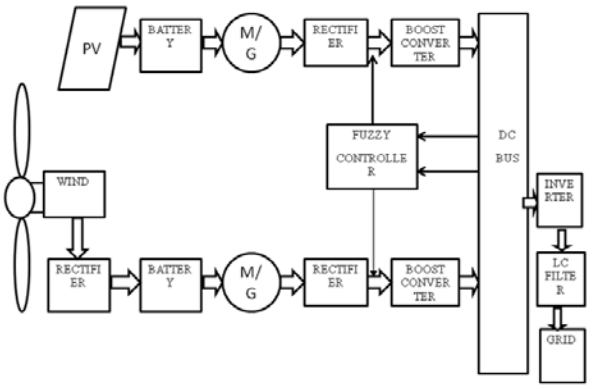

Fig. 1: Proposed Architecture

Both the PV and wind system can be output improved by using motor-generator pair. The fuzzy logic is a controller mainly used to compensate them and regulate the dc grid voltage. Finally, the improved voltage has been inverted and given to the ac grid.

Wind Turbine

A Wind turbine is a power producing gadget that is driven by the motor energy of the breeze. Wind turbines general can be categorized as one of two classes: Horizontal pivot wind turbines and vertical hub wind turbines.

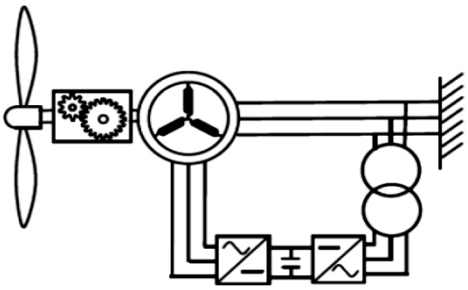

Fig. 2: Wind Turbine

A gathering of turbines in a given zone is known as a progressively a wind stopped. A breeze turbine is a gadget that changes over the breezes dynamic energy into electrical energy. The littlest turbines are utilized for applications, for example, battery charging for assistant power for pontoons or troops or to control movement cautioning signs.

Solar

Fig. 3: Solar

Sun or Solar panels absorb sunlight as a source of energy to generate electricity-heat. A photovoltaic (PV) module is a packaged; connect assembly of typically 6x10 photovoltaic solar cells. Its DC output power rates each module under standard test conditions (STC), and typically ranges from 100 to 365 Watts (W). The cost of sun-powered power has kept on falling so that in numerous nations it is less expensive than customary petroleum product power from the matrix (there is network equality). A sun based cell, or photovoltaic cell, is an electrical gadget that changes over the energy of might straightforwardly into power by the photovoltaic impact, which is a physical and compound marvel. In basic terms, a single junction silicon solar cell can produce a maximum open-circuit voltage of approximately 0.5 to 0.6 volts.

AC/DC Converter

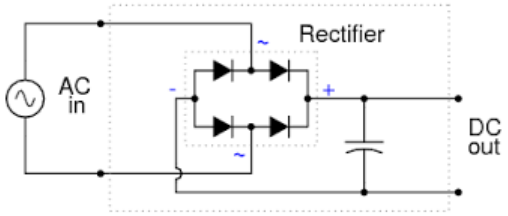

Fig. 4: AC/DC Converter

A rectifier is an electrical device composed of one or more diodes that convert alternating current (AC) to direct current (DC). A diode resembles a restricted valve that enables electrical current to stream. A rectifier can take the state of a few diverse physical structures, for example, strong state diodes, vacuum tube diodes, mercury circular segment valves, silicon-controlled rectifiers and different

other silicon-based semiconductor switches. A 120 V (rms), 50 Hz AC line that feeds the power supply, which delivers a voltage V_O to the electronic circuit (load block). Must be a stable DC voltage to ensure that the electronic circuitry functions correctly.

DC/DC Converter

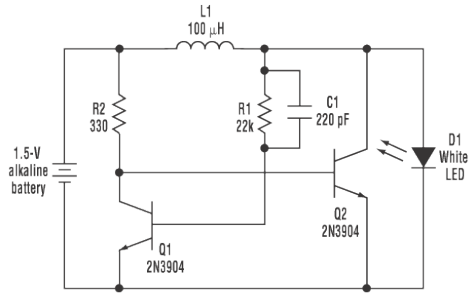

Fig. 5: Dc/Dc Converter

DC-DC converters are broadly used to proficiently deliver a directed voltage from a source that might possibly be very much controlled to a heap that could conceivably be steady. This paper quickly presents DC-DC converters, notes normal illustrations, and talks about imperative datasheet parameters and uses of DC-DC converters.).Efficiency for DC-DC converters is typically specified in curves, with peak efficiency achieved at certain load current.

Fuzzy Logic Controllers

Basic Concept of Fuzzy Logic

Attempt to control logic, Do away with sets, Boolean, true/false, etc., Allow for fractions, partial data, imprecise data, Fuzzify the data.

What Is a Fuzzy Controller

It is simply put, it is fluffy code intended to control something, generally mechanical. They can be in programming or equipment and can be utilized as a part of anything from little circuits to expansive centralized.

Fuzzy Controllers Currently Used Fuzzy Controllers

- Flight Control System
- Camcorder – Stabilization

Constructing a Fuzzy Controller

- Create the membership values (fuzzify).
- Specify the rule table.
- Determine your procedure for defuzzifying the result.

For what reason Why Should We Use Fuzzy Controllers

- Exceptionally strong.
- Can be effortlessly altered.
- Can utilize different data sources and yields sources.
- Substantially less difficult than its forerunners (straight logarithmic conditions).
- Quick and less expensive to actualize.

Fuzzy inference method is the most commonly seen fuzzy methodology. Mamdani's method was among the first control systems built using fuzzy set theory.

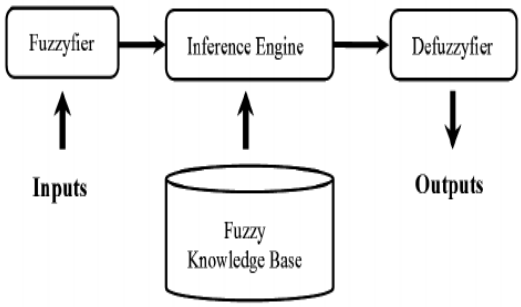

Fig. 6: Fuzzy Interfacing Method

DC Bus

DC-BUS is technology for reliable and economical communication over noisy DC or AC power lines. The DC-BUS converts the digital input data into phase modulated signals, protected against errors generated by noise over the power line. Gradually it becomes a popular means of communication in a majority of in a majority of utilization inside aviation, car; sun oriented energy administration and lighting. It is likewise utilized as a contrasting option to RS-232 and RS-485 systems now and again.

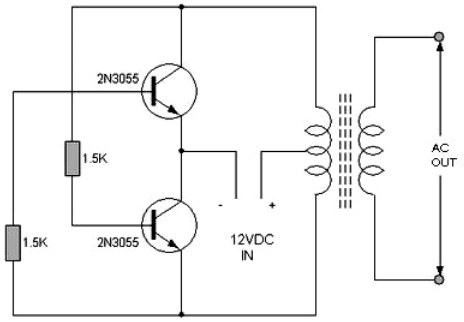

Fig. 7: Dc to Ac Converter

A power inverter, or inverter, is an electronic device or circuitry that changes direct current (DC) to alternating current (AC).DC, for Static inverters, do not use moving parts in the conversion process. Consumer and commercial inverters that typically run on a rechargeable 12 V lead-acid batteries or automotive electrical outlet. 24, 36 and 48 V DC, which are common standards for home energy systems. 200 to 400 V DC, when power is from photovoltaic solar panels.

Battery

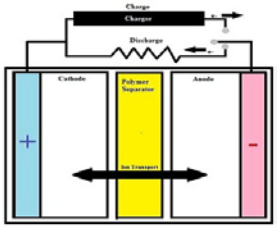

Fig. 8: Battery

An electric battery is a gadget comprising of at least one electrochemical cells with outer associations gave to vices such as flashlights, smart phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode, and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. Zinc-carbon cells have different chemistries, but approximately the same emf of 1.5 volts; likewise NiCd and NiMH cells have different chemistries, but approximately the same emf of 1.2 volts. The high electroche. The high Electrochemical potential changes in the reactions of lithium compounds give lithium cells emfs of 3 volts or more.

IV. CIRCUIT DIAGRAM

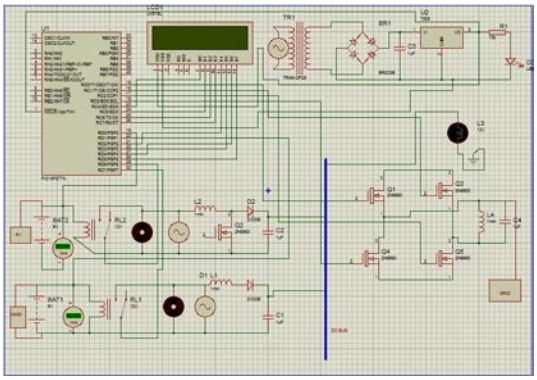

Fig. 9: Circuit Diagram

Circuit Explanation

The above circuit shows the reimbursing load voltage, load current, real power, reactive power at the three-phase fault state for voltage T=1.0 to 50 v and current T=1.0to 6A without Solar and Wind Power in linear load. The waveform calcification occurs in load side voltage due to the hybrid power. , the synchronous motor-generator pair (MGP) was proposed as a possible approach. In this paper, first, state equations considering different frequencies on both sides of the MGP are established. The model for small signal stability is further modified to include the wind generator. On this basis, two systems are tested to investigate the performance of the MGP in small signal stability, rotor angle stability, and voltage support. Finally, on the basis of the proposed control strategy, closed-loop active power controls of the MGP are realized and improve power in the experimental system.

V. RESULT AND DISCUSSION

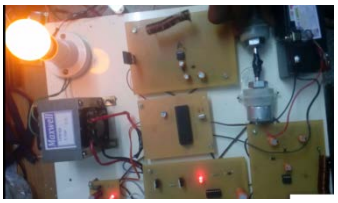

Fig. 10: Hardware Model for the Motor-Generator Pair

Hardware Output

Module rated power	Input	Existing	Proposed Fuzzy controller
PV Power	75W	100W	1kw
Wind Power	12 W	10W	3w
Fuel Voltage	12V	12V	12v
Boost Voltage	24	24	24
Switching Loss	5.1%	4.3%	3.8%
Emi	2.3%	2.01%	1.89%
Efficiency	90.2%	93.10%	95.01%
Battery Operating	2 – 10HR	2 – 18HR	2 – 18HR
MGP Power	1500w	2000w	2000W
Current	10 a	15A	6A
Load	R Load	----------	Both Linear And Non-Linear

Advantages

- Low Power Loss.
- Power Transmission Constant.

Application

- Used in industrial sectors to improve efficiency
- Small-scale working area
- Home application devices

VI. CONCLUSION

The MGP system based synchronous machines to provide a possible future power grid solution with high penetration of renewable energy and to enhance its stability. The damping level and efficiency and cost of the MGP are discussed. Then, rotor angle relation, active power regulation, small signal stability, and frequency response are analyzed and verified through experiments and simulation. MGP to deal with random of renewable energy, quantitative cost estimation compared with other solutions, capacity optimization for renewable energy using MGP to achieve grid-connection, excitation system and reactive power control for both sides, coordination control of MGPs, and models and its analysis of small signal and transient stability for large grid and a range of different cases.

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