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Power Quality Improvement in SEIG

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Abstract-*The increasing rate of the depletion of conventional energy sources has given rise to an increased emphasis on renewable energy sources such as wind, mini/micro-hydro, etc. Generation of electrical energy mainly so far has been from thermal, nuclear, and hydro plants. They have continuously degraded the environmental conditions. Use of an induction machine as a generator is becoming more and more popular for the renewable sources. The advantages of using an induction generator instead of a synchronous generator are well known. Reactive power consumption and poor voltage regulation under varying speed are the major drawbacks of the induction generators, but this our project the development of static power capacitors has facilitated the control of the output voltage of induction generators and the development of synchronous condenser has to be control the reactive power consumption. This project presents an overview of three phase self-excited induction generator (SEIG) and Reactive power with compared to the power grid electrical system.*

Keyword: Induction Generator, Static power capacitors, SEIG.

1. INTRODUCTION

The increasing rate of the depletion of conventional energy sources has given rise to an increased emphasis on renewable energy sources such as wind, mini/micro-hydro, etc. Generation of electrical energy mainly so far has been from thermal, nuclear, and hydro plants. They have continuously degraded the environmental conditions. An increasing rate of the depletion of conventional energy sources and the degradation of environmental conditions has given rise to an increased emphasis on renewable energy sources, particularly after the increases in fuel prices during the 1970s. Traditionally, synchronous generator has been used for power generation but induction generations are increasing being used these days because of their relative advantageous feature over conventional synchronous generators. Use of an induction machine as a generator is becoming more and more popular for the renewable sources. Reactive power consumption and poor voltage regulation under varying speed are the major drawbacks of the induction generators, but the development of static power converters has facilitated the control of the output voltage of induction generators.

Self excited induction generator has been a subject of considerable research over last few decades because of its perception as the simplest energy conversion device to produce electricity in off-grid, stand alone mode using different types of prime movers and employing different conventional and renewable energy resources such as oil, bio fuel, wind and small hydro. The generated terminal voltage and the output frequency, depend on the excitation capacitance, the three-phase induction machine parameters, the electrical passive load and the prime mover speed. This paper presents an overview of three-phase self-excited induction generator (SEIG).

2. LITERATURE REVIEW

Bassett and Potter have proposed a three-phase cage Induction Machine (IM) as a self-excited generator connected to the AC side of a voltage source. The generator is supposed to be driven by a low head unregulated shaft of micro system. These systems intended to be applied in rural plants as a low- cost source of high quality AC sinusoidal regulated voltage with constant frequency.

Wildi has proposed the voltage and frequency control of an autonomous Induction Generator (IG). A Voltage Source Inverter (VSI) with a Dump Load (DL) circuit is employed in its DC side. The IG frequency is controlled by keeping the VSI synchronous frequency constant.

Yokesh et al. (2010) proposed a voltage regulation scheme for Self-Excited Induction Generator for industry applications and analyzed the system with the help of different voltage and load conditions.

This paper considers the development of static power capacitors has facilitated the control of the output voltage of induction generators and the development of synchronous condenser has to be control the reactive power consumption.

3. EXISTING METHOD

Micro-hydro generation system based on a single phase induction motor, which can regulate voltage to 219±1V and frequency to 49.9±0.3Hz as the system load increases from 0 to a maximum design limit of 500W. The system uses switched excitation capacitors to regulate the AC voltage, and a phase controlled resistive dump load to regulate the AC voltage and frequency, as load conditions and the energy available from the prime mover micro hydro turbine vary. The controller is based around a low cost microprocessor, which has the further advantage of allowing flexible control strategies to be easily implemented and tuned to suit any particular induction generator and prime mover system.

4. PROPOSED METHOD

4. 1. Functional Block Diagram

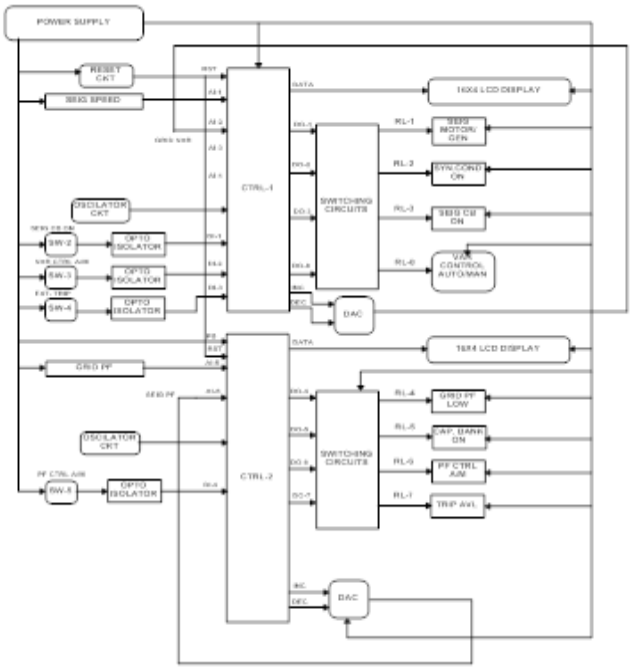

Fig -2: Block Diagram

4. 2. DESCRIPTION OF PROPOSED METHOD AND ITS FUNCTIONAL UNITS

The block diagram shows how the induction Generator is run with the help of external forces such as Diesel Engine, wind energy or any other drives. Three phase voltage will develop at the terminal of Induction Generator when that generator speed above the rated speed, One Circuit Breaker (CB-1) is connected between Induction Generator output terminals and Power supply grid. Power Grid Reactive power (Var) and Power factor was measured with the help of Transducers and also measure the Reactive power (Var) and Power Factor of Induction Generator.Grid reactive power and Induction Generator reactive power was connected to one Microcontroller. Grid Power factor and Induction Generator Power factor was connected to another Microcontroller.

4. 3. SEIG

A squirrel cage induction generator (SCIG) is more attractive than a conventional synchronous generator in this type of application because of its low unit cost, absence of DC excitation source, brushless cage rotor construction and lower maintenance requirement. A suitably sized three-phase capacitor bank connected at the generator terminals is used as variable lagging Var source to meet the excitation demand of the cage machine and the load. The machine operated in this mode is known as a Self-excited Induction Generator (SEIG).

4. 4. Capacitor Switching

A particular challenge with this system was to arrange for the capacitors to be switched into the circuit without creating a significant current surge that would damage the triac switches. The elegant solution that was developed was to use a diode/resistor network to maintain the capacitor voltage at the AC voltage peak when the capacitor was not in circuit, and to switch on its associated triac as the generator voltage passes through its peak. This avoids any capacitor inrush surge current. Of course, this solution relies on the controller accurately switching the triac at the AC voltage peak, but this is not difficult using a microprocessor. Furthermore, any slight errors in switching have minimal impact on transients when switching at peak voltage, since the gradient of a sinusoidal waveform is at a minimum at its peak.

4. 5. PIC

PIC 16F877A is used .PICs are low cost, easily available, it has large user base and serial programming capability.It is used to collect the parameter value from the sensor unit and compare it with the set point and transfer the corresponding data to the CPU.PIC 16F877A is a 8-bit.It has 40 pins and 256 bytes. Operating voltage of this PIC 16F877A is 2 to 5.5v. It uses Flash memory and it is self programming.The robot can be controlled in both manual mode and automatic mode most of them work in manual mode. The automatic mode robot is programmed within the embedded chip.

5. CONCLUSION

In isolated systems, the use of a SEIG offers many advantages over a synchronous generator. It is desirable that the cost of an isolated system should be very low so that the cost of power produced from it can be afforded by the poor community residing in an isolated area. Use of the SEIG compared to the synchronous generator can reduce the system cost considerably.

This paper has presented a cheap and robust micro-hydro generation system based on three phase self exited induction generators. The system uses switched excitation capacitors to regulate the AC voltage, and a phase controlled resistive dump load. The controller is based around a low cost microcontroller, which has the further advantage of allowing flexible control strategies to be easily implementation. SEIGs have been mainly analyzed in a single system like wind or micro hydro, etc. and contributions in dual or multisystem, such as wind–diesel, wind–diesel–micro hydro, etc.are almost negligible. It is expected that better methods of reactive power/voltage-control techniques will make the SEIG more suitable for isolated applications.

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