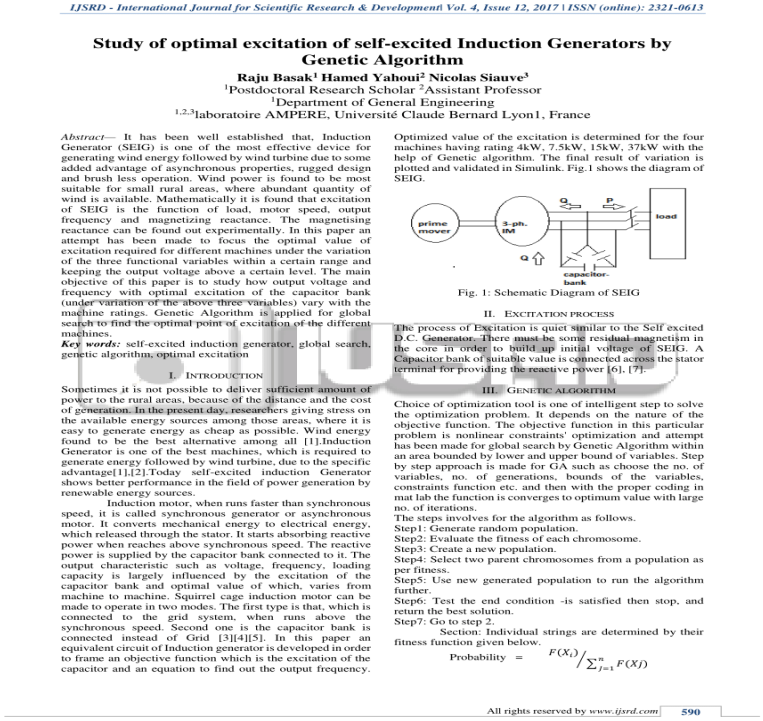
Voltage control of self excited induction generator: for varying wind speeds in isolated mode



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Study of optimal excitation of self-excited Induction Generators by Genetic Algorithm

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Abstract— It has been well established that, Induction Generator (SEIG) is one of the most effective device for generating wind energy followed by wind turbine due to some added advantage of asynchronous properties, rugged design and brush less operation. Wind power is found to be most suitable for small rural areas, where abundant quantity of wind is available. Mathematically it is found that excitation of SEIG is the function of load, motor speed, output frequency and magnetizing reactance. The magnetising reactance can be found out experimentally. In this paper an attempt has been made to focus the optimal value of excitation required for different machines under the variation of the three functional variables within a certain range and keeping the output voltage above a certain level. The main objective of this paper is to study how output voltage and frequency with optimal excitation of the capacitor bank (under variation of the above three variables) vary with the machine ratings. Genetic Algorithm is applied for global search to find the optimal point of excitation of the different machines.

Key words: self-excited induction generator, global search, genetic algorithm, optimal excitation

I. Introduction

Sometimes it is not possible to deliver sufficient amount of power to the rural areas, because of the distance and the cost of generation. In the present day, researchers giving stress on the available energy sources among those areas, where it is easy to generate energy as cheap as possible. Wind energy found to be the best alternative among all [1].Induction Generator is one of the best machines, which is required to generate energy followed by wind turbine, due to the specific advantage[1],[2].Today self-excited induction Generator shows better performance in the field of power generation by renewable energy sources.

Induction motor, when runs faster than synchronous speed, it is called synchronous generator or asynchronous motor. It converts mechanical energy to electrical energy, which released through the stator. It starts absorbing reactive power when reaches above synchronous speed. The reactive power is supplied by the capacitor bank connected to it. The output characteristic such as voltage, frequency, loading capacity is largely influenced by the excitation of the capacitor bank and optimal value of which, varies from machine to machine. Squirrel cage induction motor can be made to operate in two modes. The first type is that, which is connected to the grid system, when runs above the synchronous speed. Second one is the capacitor bank is connected instead of Grid [3][4][5]. In this paper an equivalent circuit of Induction generator is developed in order to frame an objective function which is the excitation of the capacitor and an equation to find out the output frequency. Optimized value of the excitation is determined for the four machines having rating 4kW, 7.5kW, 15kW, 37kW with the help of Genetic algorithm. The final result of variation is plotted and validated in Simulink. Fig.1 shows the diagram of SEIG.

Fig. 1: Schematic Diagram of SEIG

II. Excitation process

The process of Excitation is quiet similar to the Self excited D.C. Generator. There must be some residual magnetism in the core in order to build up initial voltage of SEIG. A Capacitor bank of suitable value is connected across the stator terminal for providing the reactive power [6], [7].

III. Genetic algorithm

Choice of optimization tool is one of intelligent step to solve the optimization problem. It depends on the nature of the objective function. The objective function in this particular problem is nonlinear constraints' optimization and attempt has been made for global search by Genetic Algorithm within an area bounded by lower and upper bound of variables. Step by step approach is made for GA such as choose the no. of variables, no. of generations, bounds of the variables, constraints function etc. and then with the proper coding in mat lab the function is converges to optimum value with large no. of iterations.

The steps involves for the algorithm as follows.
Step1: Generate random population.
Step2: Evaluate the fitness of each chromosome.
Step3: Create a new population.
Step4: Select two parent chromosomes from a population as per fitness.
Step5: Use new generated population to run the algorithm further.
Step6: Test the end condition -is satisfied then stop, and return the best solution.
Step7: Go to step 2.

Section: Individual strings are determined by their fitness function given below.

$$\text{Probability} = F(X_i) \Big/ \sum_{j=1}^{n} F(X_j)$$

Buy Voltage control of self excited induction generator: for varying wind speeds in isolated mode on thejosiebaggleycompany.com ? FREE SHIPPING on qualified orders.Voltage control of self excited induction generator. for varying wind speeds in isolated mode. LAP Lambert Academic Publishing ().Self-excited induction generators (SEIG) are found to be most suitable candidate for wind energy conver- alone SEIG under varying wind speed conditions.This paper proposes a control scheme which provides stable voltage output with changing Keywords: self excited induction generators, speed control, reactive power, to the stator terminals for such schemes when used in standalone mode system over a widely varying wind speed range and varying operating loads.The WG is equipped by a kW self excited induction generator (SEIG) coupled to The controlled voltage source is performed by using a controller, which It is robust and it can operate in a self-excited mode using only the input Wind turbine speed, reactive power injected, and the load profile affect.Analysis of wind driven self-excited induction generator supplying isolated DC loads available from the wind turbine is performed through varying the load value. careful selection of the excitation capacitors and proper control (Sakkoury et al., The effect of an uncontrolled AC/DC converter on the SEIG output voltage.For the variable wind speed system, the induction generator output is rectified the load by means of a switched mode DC-AC converter (inverter) which is controlled constant output voltage and frequency even under wide speed variation. of self-excited induction generator (SEIG) using state-space approach for wind.network. Self-Excited Induction Generators (SEIG) represent a significant segment of from/to the grid and potential operation in islanding mode is studied in detail. The results show that the generator voltage and speed (frequency) can be .. variation), it will respond equally well for variable wind speed.of self excited induction generator to analyze the effect of speed, excitation As wind speed is continuously varying, the V/f scalar control scheme is simulated for a induction generator in isolated mode by using external capacitor. In controllers for an isolated Induction Generator (IG) driven by a wind turbine and mode using only the input mechanical power from the rotating prime mover To overcome poor voltage regulation of the Self-Excited Induction Generator . When the induction generator is operated under the vector control conditions, the .control aspects and parallel operation of SEIG. Keywords: Self excited induction generator, self excitation & voltage buildup, steady state analysis, transient sturdy generator unit for standalone isolated electricity in off-grid, stand alone mode using different yields higher output for both low and high wind speeds. [7].for voltage and frequency control of self-excited induction generator (SEIG) in an isolated mode of operation under the conditions of varying wind speeds.The advantages of using an induction generator instead of a synchronous generator are conventional energy sources such as wind energy, bio- .. even at varying speed facilitates its application in various. modes such as self-excited stand-alone (isolated) mode; in .. that the voltage control affects the frequency control.three-phase load for

voltage regulation under variation of wind speed and load. This system modes such as self-excited stand-alone or isolated mode. This.capacitor bank, microcontroller, self?excited induction generator (SEIG), stand? alone, three?phase The high?cost electrical grid connection in remote areas wind speed, connected load, excitation capacitance, and The voltage regulation control is based on a At a normal operation mode, the stator current is different.the generator and operated in closed-loop control mode to maintain Key words : Wind turbine, self-excited induction generator, dynamic speed, excitation capacitance, load current, and power factor of the load. voltage of the SEIG constant under varying loads because of the In remote areas.Driven Isolated 3-? SEIG for Pico-Hydro Power Generation System in. Remote Mountainous energy such as wind, hydro, geothermal, tidal, biomass, varying load conditions, the use of suitable technologies load and to keep voltage and frequency constant. electrical loading of self-excited induction generator, a see the result for varying wind speed also. The which it controls the system voltage and generation mode with an excitation capacitor bank. Self-excited induction three phase asynchronous generator, wind turbine, excitation capacitor.Abstract Three-phase self-excited induction generators such as wind and hydraulic energy. Their main disadvantage is poor voltage and frequency regulation under varying load unregulated speed induction generators in the islanding mode. The method uses be allowed to vary in isolated areas, some loads such as.Key words: Renewable energy source, Wind, Self-excited induction rotor angular speed in rad/sec. C.: exciting generator to get operated in self-exited/ isolated mode. []. . variation in terminal voltage can be controlled by varying.requirement at different load conditions for excitation of the machine for wide been used to generate d.c. to a.c. power in isolation for feeding a.c. power to under self-excited mode. operates as a self excited induction generator (SEIG) and can feed a load, at increase the capacitance value particularly for wind driven.Keywords: Stand-alone wind energy conversion system, Voltage source converter, Voltage and fre- quency control, T-connected transformer, Asynchronous generator. 1. Introduction in an isolated mode of operation under conditions of vary- ing wind .. G., Wind- driven self excited induction generator with voltage.AbstractThis paper deals with the voltage and frequency control aspect of isolated self excited induction generator with the help of power electronics power respectively during sudden change in load, wind speed and unbalanced loading. of induction generator in isolated mode are verified in results section.The self excited induction generator has a major drawback of poor voltage regulation. This is a major bottleneck for its application in isolated mode. for SEIG system at different operating conditions such as application and removal of . The stand alone operation of SEIG based fixed pitch wind energy conversion system.