CONTROLLING OF SEIG WITH V/F CONTROLLER IN STANDALONE CONDITIONS

B. SREEKANTH, G. SUDHEER

1Student, Dept Of Electrical And Electronics Engineering, G.Pulla Reddy Engineering College (Autonomous), Kurnool, A.P, India
2Assistant Professor, Dept Of Electrical And Electronics Engineering, G.Pulla Reddy Engineering College (Autonomous), Kurnool, A.P, India

Email ID: sreekanthsri44@gmail.com, gsudheer252@gmail.com

Abstract: Induction generators are gradually more being employed in nonconventional energy systems for example wind, micro-mini hydro, etc. The benefits of using an induction generator rather than a synchronous generator are eminent. Some of them are condensed unit cost and size, roughness, brushless (in squirrel cage construction), lack of separate dc source, simplicity of maintenance, self-protection versus severe overloads and short circuits, etc. In isolated systems, squirrel cage induction generators with capacitor excitation, known as self-excited induction generators (SEIGs), are very popular. The V/f control pattern for motoring function is properly developed to the SCIG for calculating both voltage build-up and dynamic transients. The proposed system design is presented using MATLAB/SIMULINK.

Keywords: SEIG, VSC, V/f controller.

I. INTRODUCTION

The growing esteem of the diminution of conventional energy sources has given arise to an improved importance on renewable energy sources such as wind, mini/micro-hydro, etc. Creation of power mainly so far has been from heat, atomic, and hydro vegetation. They have consistently deteriorated the ecological conditions. An increasing rate of the reduction of traditional resources of energy and the deterioration of ecological conditions has given rise to an increased focus on alternative energy, particularly after the improves in energy prices during the 1970’s. Use of an introduction machine as a creator is becoming more and more popular for the alternative resources. Sensitive energy consumption and poor volts control under different speed are the major disadvantages of the introduction turbines, but the development of fixed energy converters has assisted the control of the outcome volts of introduction turbines.

In this project, a VSC-based plan for efficient and complete excitation of the SEIG is suggested, which prevents both the ac capacitor and battery power financial institutions. The overall system design is shown in Fig. 1. Initial volts in the dc bus is based on the terminal voltages of the unexcited device, produced because of long lasting magnetism of the permanent magnetic primary, and thereafter fixed by the anti-parallel diodes of the VSC. Voltage build-up is obtained by managing the device slide rate. A dc bus volts operator is designed based on traditional V/f management of IG. This operator guarantees both volts build-up under no fill as well as volts management under different fill and generator rate. For volts build-up, a slam referrals is used for the dc bus volts. Choice of the slam mountain is critical for successful build-up and this aspect is mentioned. The blades flux is managed at its ranked value to ensure increased international airport volts, hence greater outcome power, at greater generator rates of speed. The proposed scheme is first demonstrated through simulation on MATLAB/SIMULINK platform.

II. MODELING OF PROPOSED SYSTEM DESIGN

An induction machine can be worked as a stand-alone generator. Capacitive self excitation of introduction device is known for many years. Self-excitation in introduction device is started by recurring magnetism living in the blades primary. These devices are later known as self-excited introduction devices. The essential advantage of introduction device is its ability to generate continuous volts and continuous regularity outcome for different rates of speed. In most of the situations the IM is of lines linked type in which situation it takes the necessary sensitive energy support from the lines. But there are certain situations where the IM has to function as stand-alone creator, in which situation it needs some sensitive energy for self-excitation. So we have to provide capacitors for this objective. Another disadvantage of this method is its inadequate volts and regularity control for changes in rate and fill. Reactive energy stability needs...
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different capacitance, which can be provided with energy semi-conductor tour. Effective energy stability, on the other hand needs exterior components to redirect the extreme energy from the system, when the resource energy surpasses the amount required by the fill. Excessive energy can be consumed by the resistors linked with the blades or stator devices. Another disadvantage is that the device demagnetizes and prevents producing volts either when breeze rate drops below or the fill increases beyond certain principles. After that even with the breeze rate at the fill international airport getting back to the ranked principles, the introduction device cannot begin working without the aid of an reliable resource of energy and a operator.

The sensitive energy volt-ampere specifications of IG are provided by means of VAR-generator linked with stator devices. The shunt capacitors may be continuous or may be different through energy electronic devices (or step-wise). SEIGs may be designed with single-phase or three-phase outcome and may supply ac (AC) plenty or AC fixed (direct present [DC]) independent plenty. We also include here SEIGs linked with the energy company through soft-starters or resistors and having capacitors at their devices for energy aspect settlement (or volts stabilization).

**Modeling of VSC and DC side circuitry**

For replicating the three-phase VSC, its efficient design is used. The VSC is turned by sine PWM strategy and the voltages and voltages of ac and dc part of VSC are relevant as

\[
\begin{bmatrix}
  v_a \\
  v_b \\
  v_c
\end{bmatrix} =
\begin{bmatrix}
  m_a \\
  m_b \\
  m_c
\end{bmatrix}^T
\begin{bmatrix}
  v_{dc}
\end{bmatrix}
\]

where va, vb and vc are the IG phase voltages and ia, ib and ic are the IG line currents. vdc and ide are dc side voltage and current, correspondingly, ma, mb and mc the modulation indices of relevant phases and Sa, Sb and Sc the equivalent switching functions. The switching function takes the value of 1 when the switch is on and 0 when off.

Dynamic equation for the dc bus voltage is derived as follows. Equating currents at the VSC dc bus, as shown in Fig. 1, the following governing equation is obtained

\[
\frac{d v_{dc}}{dt} + \frac{1}{C_{dc} v_{dc}} = \frac{i_{dc}}{C_{dc}}
\]

where io is electrical load on the dc bus. The dc bus voltage controller is calculated in a successive section, in relation to the model defined by (3).

**Control approach**

The V/f control method is an output-feedback system. Because the machine currents comprise inner states of the system, these are not directly regulated through control action. The machine is modeled as an algebraic gain between the electrical torque and slip speed. Steady-state machine flux is held constant by maintaining the ratio \((V_s/\phi_e)\) at a fixed value.

A dc bus volts operator is designed to management the slip speed (vsl). This operator generates negative slip speed, which is added with the measured rotor speed (vr) to produce the regularity of excitation. A look up table which stores the essential stator volts against regularity information, is used to decide the volts control to the VSC. Control is worked out in randomly rotating reference frame. This allows two separate management information to the system, although the only managed outcome is the machine twisting. To obtain a one-to-one applying of outcome mistake to management feedback, the d-axis volts is consistently set to zero and the q-axis volts is straight set by the look-up desk outcome. The volts information in the desk are saved in terms of optimum stage volts (in comparative Y-connection), which avoid any climbing while drawing the q-axis volts referrals. Thus, volts is ideally indicated as

\[
v_q = v_{qs} = \sqrt{2} K_r \omega_m
\]

where vqs is the q-axis voltage command to the VSC.

**Simulation Results**

The proposed scheme is verified through simulation on MATLAB-SIMULINK platform. Dc bus volts and rate are felt and fed back again for control. Simulator outcomes for both dc bus volts build-up and management are mentioned in the following segments.

**Simulation Diagram**

![Simulation Diagram](image)
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CONCLUSION

This project has provided a extensive technique of power creation in WECS using SCIM. A novel plan for dc bus volts build-up is provided, which needs no extra components assistance like battery power at dc bus or any capacitor financial institution at IG devices. Powerful behavior of IG factors have been examined under different fill and breeze rate circumstances. The simulation results make sure good dynamic control of the dc bus volts with very small changes around its referrals value. The effective execution of the suggested plan is based on volts build-up, which depends on the durability of long lasting magnetism and inner resistances of the IG. As the ranking of the IG improves, long lasting durability of the primary improves, whereas resistances reduce.

REFERENCES