Voltage and Frequency Regulation of SEIG Using Matrix Converter

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Abstract: With the growth in technologies, solid-state converters (described in next section) have been used for variable speed control method. The most desirable features in frequency converters (solid-state converters) are the more probability of generating load voltages with variable amplitude and frequency. The main objective of this thesis was to develop a transformer less wind energy conversion system for standalone system and the objective of this to develop a simulation model for SEIG and Matrix Converter. Along with development of a venturini control algorithm for Matrix Converter switching control.

1.1 Introduction

The concern that world's demands on the non-renewable resources that are used to power industrial society are decrease as the demand rises called as energy crisis. These conventional resources are in limited supply. These resources developed naturally and it can take thousands of years to reload the stores. *In popular literature though, "it often refers to one of the energy sources used at a certain time and place, particularly those that supply national electricity grids or serve as fuel for vehicles".*

In Grid Connected Induction Generators, it draws reactive power from the grid to maintain its air gap flux. Voltage and frequency at machine in grid-connected system will be imposed by the electric grid, since it is very small compared to the whole system. Fig 1.1, represents GCIG. There will be large inrush and voltage drop in GCIG during connection and its operation makes the grid weak. The performance of the GCIG under balanced and unbalanced faults should be thoroughly investigated to ensure good quality and reliable power supply [7].

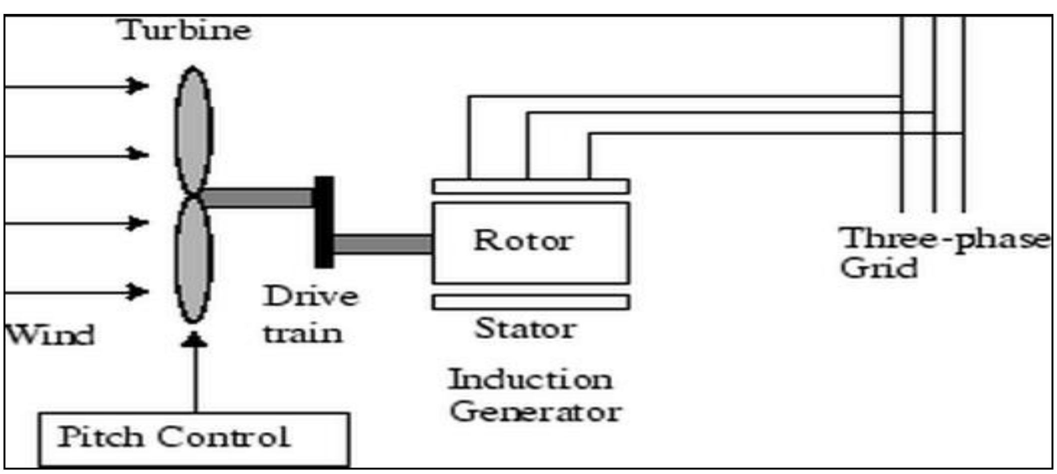

Fig1.1 Block Representation of GCIG

1.2 Classification of Induction Generator

A tabular classification of IG is shown in fig1.2.

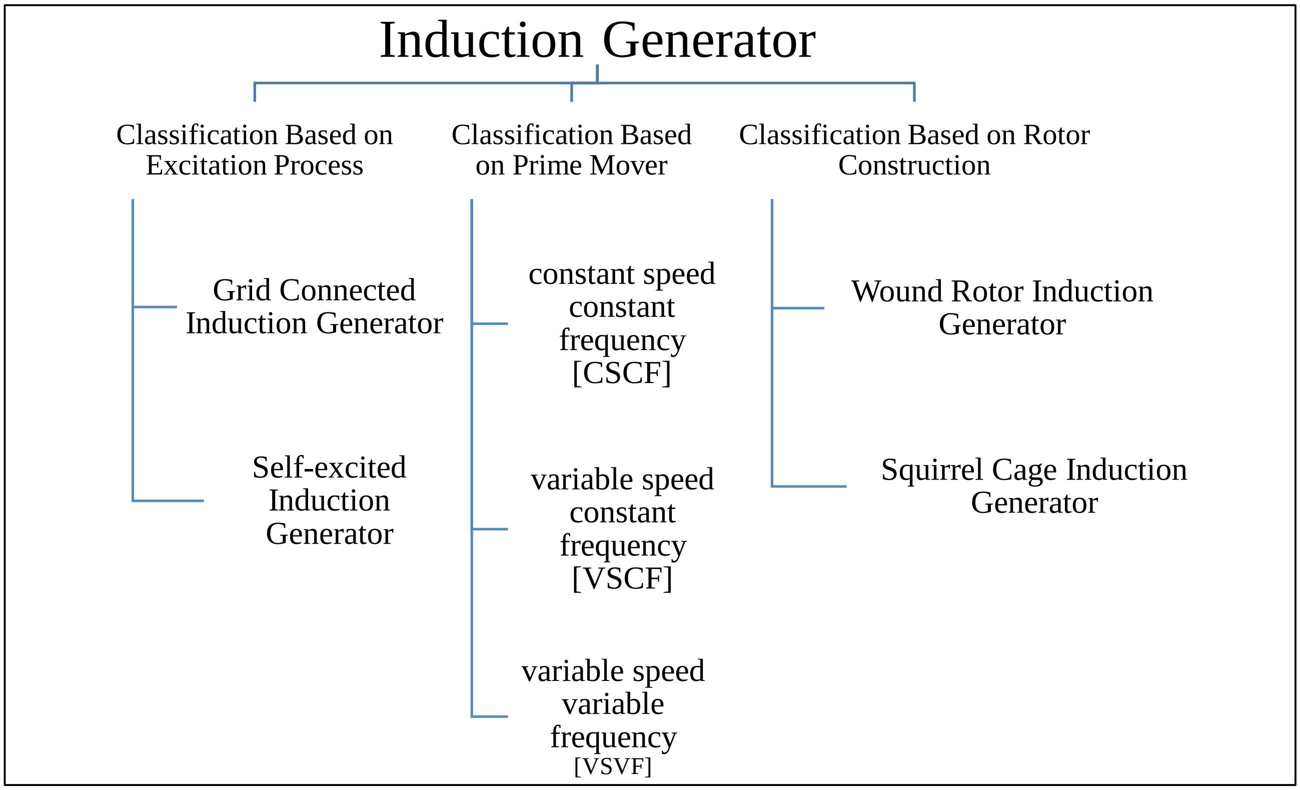

Fig 1.2 Classification of Induction Generator

1.3 MATRIX CONVERTER

A matrix of bidirectional power switches (m × n) can be arranged where m represents input phase and n represents output phase, for voltage source or current source on the input side shown in fig. 1.3. The conventional matrix converter proposed by Venturini and Alesina in the work was named voltage source matrix converter (VSMC). Whereas, the current source matrix converter (CSMC) can be realized by a matrix of bidirectional power switches connected to the current source. The functions of the switches (transfer matrix) in CSMC which are fed by current sources are transposed with the function of VSMC and, for this reason, the source inductances must never be opened. On the other hand, the output terminals (capacitors) should not be closed because load has capacitive in nature [11]. These rules are the opposite of the rules relating to VSMC. As is presented in [37] the voltage transfer ratio in CSMC is greater than one which is very attractive advantage of CSMC, but due to the current sources, the CSMC topology cannot be developed.

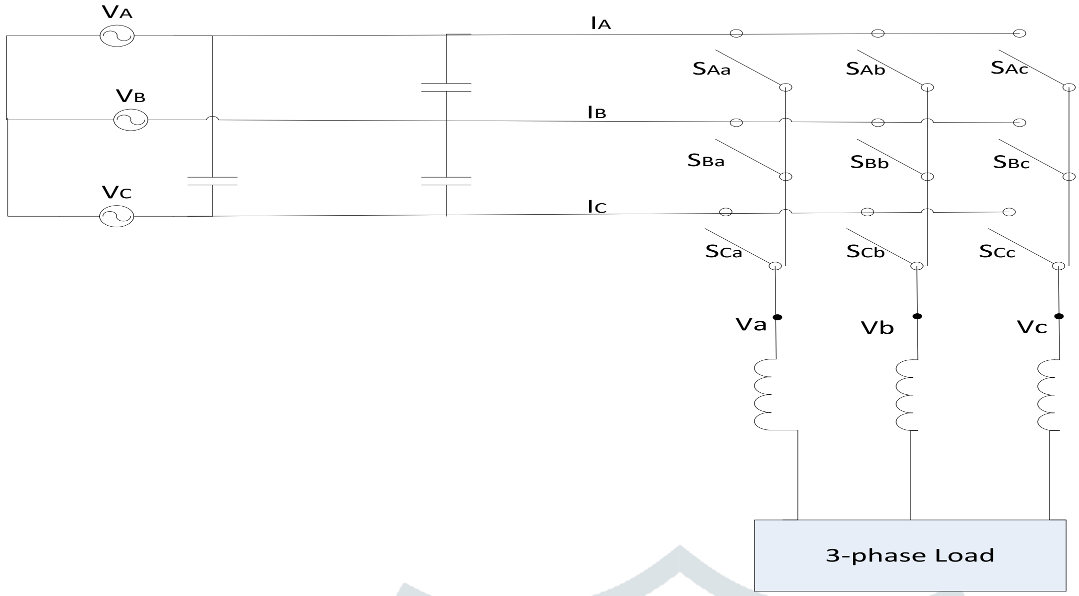

Fig. 1.3 Matrix Converter

The main advantage of matrix converter was that it replaces the multiple conversion stages and the intermediate energy storage element by a single power conversion stage. It is arrange such that each input phase is connected to each output phase and by this arrangement of switches, the power flow through the converter is bidirectional.

In this research paper, ***two IGBT with two free-wheeling diodes*** topology is used for modeling of switches. Fig.1.4 represents the simulation model of switches.

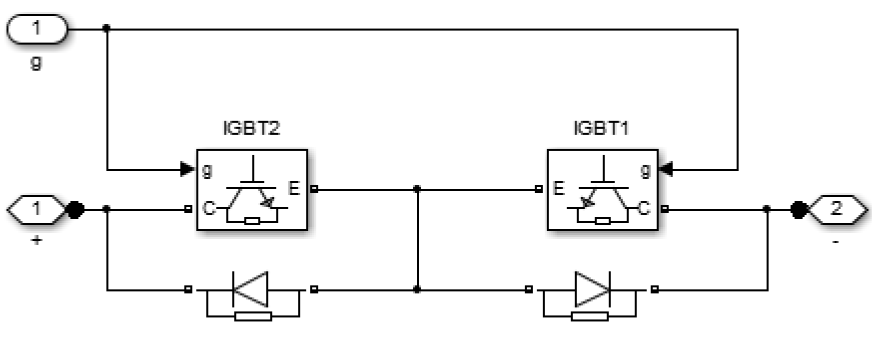

Fig.1.4 Simulation Model of bi-directional Switch

1.4 RESULTS:

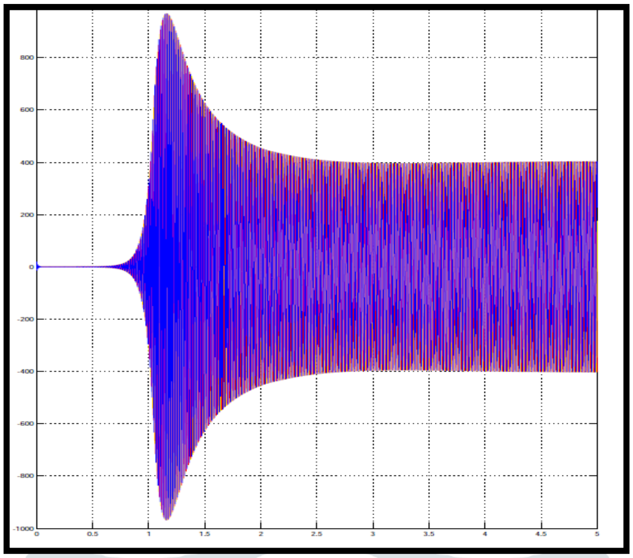

Fig.1.5 SEIG Three-phase No-Load Voltage

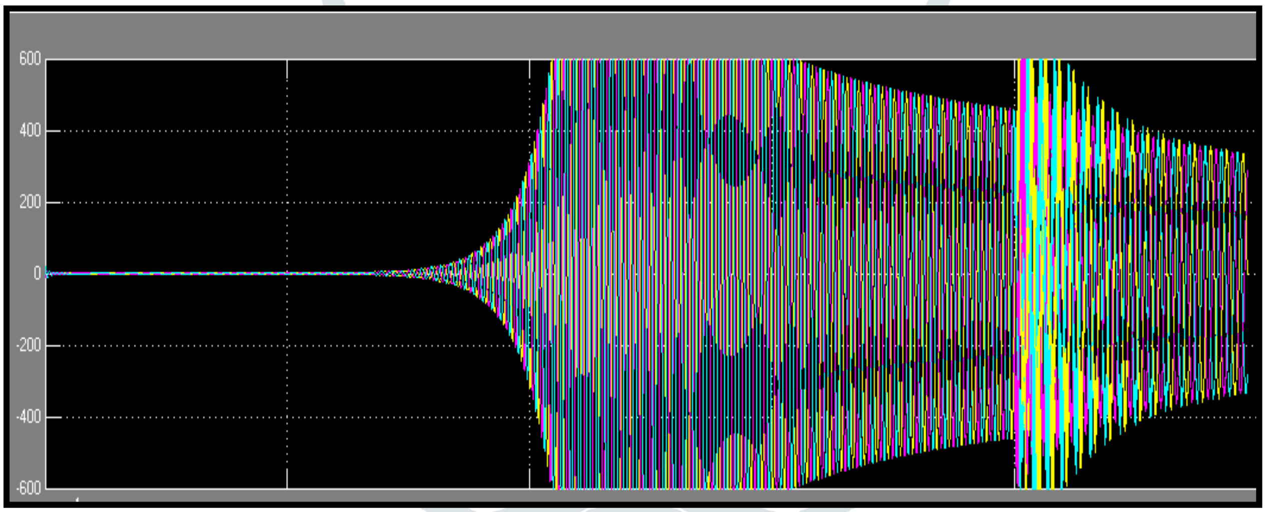

Fig. 1.6 SEIG Voltage at No-Load with Matrix Converter

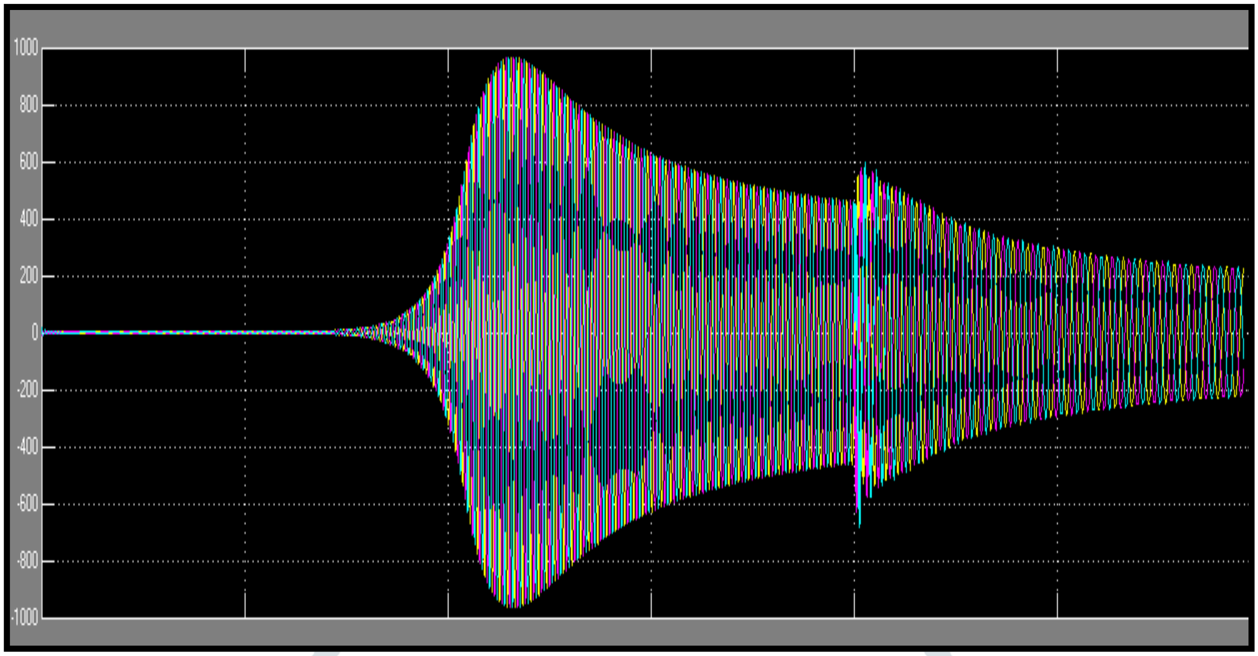

Fig. 1.7 SEIG Three-Phase Voltage at 150W with Matrix Converter

1.5 CONCLUSION

The work in this research work concern on voltage and frequency regulation of self-excited induction generator. With the development of static power converter this inability was overcome. With the help of matrix converter, voltage and frequency can be controlled. From the above result it was concluded that; from the result, it was concluded that with the help of matrix converter the voltage of SEIG can be controlled. But there need to improvement in designing of matrix converter and its output and input filter.

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