Reduction of Grid Fault Synchronization Time for Distributed Generation Systems by Application of Hysteresis PWM Technique

Vijay Malviya[1], Prof. Santosh Kumar[2]
[1]Mtech. Scholar, [2]Research Guide
Millennium institute of technology and science, Bhopal

Abstract- Due to the emerging application of distributed generation (DG), large numbers of DG systems is expected to deliver electricity into the distribution network in the near future. For the most part these systems are not ready for riding through grid disturbances and cannot mitigate unwanted influences on the grid. On the one hand, with the increasing use of sensitive and critical equipment by customers, the electricity network is required to serve high voltage quality. On the other hand, more and more unbalanced and nonlinear equipment, including DG units, is negatively affecting the power quality of distribution networks. To adapt to the future distribution system, the inclination for grid-interfacing converters will be to incorporate voltage quality improvement with DG usefulness. , The most augmented procedure utilized for grid synchronization in three-phase three wire system is a synchronous reference Frame PLL (SRF-PLL), The SRF-PLL works precisely during balanced condition, but cannot estimate voltage components during unbalanced condition. The synthesis and result analysis show that their harmonic-distorted performance is not really acceptable, A new algorithm based on SRF-PLL, decoupled multiple synchronous reference frame PLL (DMSRF-PLL) might be a better solution for accurate detection of the positive- and negative-sequence voltage components under unbalanced and harmonic distortion condition. A new method has proposed and implemented hysteretic is based on the PWM technique which is the most advanced and efficient technique used for the power control mechanism for the distribution generation system of power.

Indexed Terms- Power control algorithms, PLL, PWM, DG, and Hysteresis.

I. INTRODUCTION

The electrical power system has played a critical role in the development of human civilization. It has become a basic necessity in the lives of humans. These requirements have grown continuously and to cope with the demand, it has been achieved through best utilization of maximum energy resources and components to generate electricity to satisfy customer needs. With the increase in power demand, renewable energies such as wind turbines, solar panels and wave power plants have started to play a vital role in the global energy system. The integration of renewable energy into the power system can potentially cause severe challenges for the control and protection of large central generators and the distribution system. A careful design, planning, installation and operation of complex distribution system with renewable energy resources ought to be carried out. In this context, the electrical transmission and distribution plays a significant role in transporting energy from the generator site to customers. Despite the capacity of such a complex network, constant disturbances remain in the system which may be dangerous both for the customers and the power electronics equipment in the network. It is therefore recommended that the damage cause by disturbances should be limited and isolated by fast switching protection devices without affecting the rest of the distribution system.

An electric grid is an interconnected network for delivering electricity from suppliers to consumers. Electrical grids are affected by various occurrences like continuous connection and disconnection of loads, harmonies, faults caused by nature or equipment failure. Penetration of distributed power generation systems (DPGS) based on renewable energy sources (RES) in recent year have increased significantly. Grid connection requirements (GCRs) state that DPGS should ride through grid disturbance without tripping as successfully as the conventional power plants they replace. The widespread use of power electronics systems will result even better performance than the conventional power plants. This requires the improvement of control and design of power converters for ride through different kinds of faults. The control scheme of the grid-side converter (GSC) mostly depends on two cascade loops. One is an internal current loop, which regulates the grid current and another one is external voltage loop, which controls the de-link voltage. The control of the GSC is based on a de-link voltage loop and it is designed for balancing the power flow in the system. low voltage network in the centralized power system.

A basic requirement in connecting any generator to a power system is that it must not adversely affect the quality of electricity supplied to other customers on the network [1]. Although significantly increasing number of DG systems are expected to deliver electricity into the grid in the near future, they might not offer the desired voltage quality level automatically. So far, conventional grid interfacing techniques are not ready for riding through grid disturbances and for mitigating unwanted influence on the grid. On the contrary, with increasing grid- connected application of renewable energy sources, combined DG systems may cause power quality problems.

Due to the power injection from DG to the grid, the resulting voltage drop on the feeder impedance will lead to steady-state voltage rise when there are no loads or the loads located close to the DG systems consume less power than supplied by the DG systems.

Consequently, asymmetrical distribution of single-phase DG systems will cause voltage unbalance in the grid. Ideally, a large number of single-phase DG systems would be evenly distributed among the three-phase feeders and therefore no voltage unbalance problems should occur. In practice, any difference will cause voltage imbalance.

II. CONTROL SYSTEM ARCHITECTURE

The theory of controlling dynamical systems has a long history. Automated control of dynamical systems becomes more and more important, even more with the developments of robotics. Many applications are developed because of the natural laziness of humans, and desire for comfort. One can think of house thermostats, cruise control, automatic gear transmission, segways, etc. Automatic control is also important because a human being cannot control manually everywhere, where control is needed, one can think of satellite movement corrections to keep a satellite in its orbit. Also, a human is often not capable to control the system fast and precisely enough, one can think of balancing a multiple inverted pendulum or a robot on stairs, or an automated system is much faster, cheaper, more predictable and hopefully more reliable then a human being.

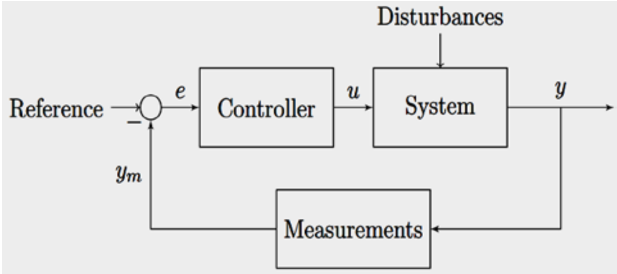

Figure 1.1 A basic control system with feedback control.

The control of systems subject to hysteresis. The phenomenon hysteresis is a wide subject which has branches in physics, chemistry, mechanics and financial matters. Scientific speculations were made in the 70's by Krasnoselskii . To present the issues which emerge because of hysteresis, the marvel is portrayed and an illustration will be investigated. Hysteresis is the impact that a framework relies on upon its present state, as well as on its past.

III. PROPOSED WORK

A. Hysteresis Current controller

In the vector control scheme, the present controller has coordinate impact on the drive execution and its plan requires extraordinary contemplations. The fundamental prerequisites for the present controllers are low harmonics to reduce losses, torque pulsation, low commotion in the engine, and fast response in order to provide high dynamic performance the logic operation of the voltage source inverter under current control is accounted. There are eight switch mixes for the six switches of the inverter. The voltage vectors relating to the dynamic states are appeared in Fig. The six summons voltages relate to dynamic voltage vectors; the staying two volgate compare to the zero voltage vectors.

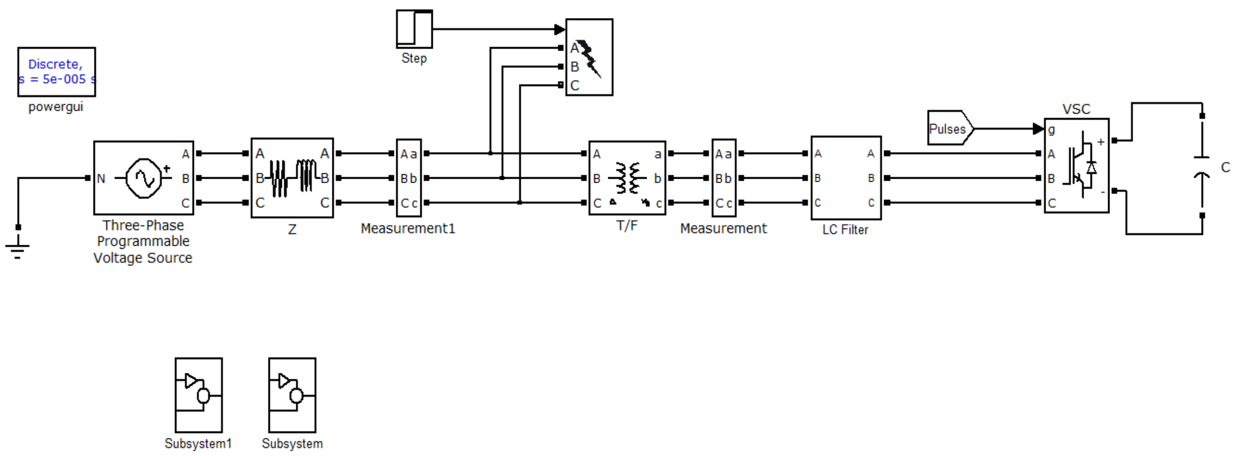

Figure 3.2 Simulation model of the proposed system.

In a basic implementation of the hysteresis current controller, the switching signals are derived from the comparison of the current error with a fixed hysteresis band. Although it is simple and extremely robust, the control technique suffers several drawbacks, mainly the variation of the modulating frequency of the power converter. Generally speaking, a three-phase VSI does not work properly if controlled by three independent hysteresis loops. This is due to the inherent coupling between the inverter three phases. Figure 3 shows that the use of individual controllers provides mutual interactions of the controllers and current errors equal to twice the imposed tolerance band ΔI.

IV. SYNTHESIS AND RESULT ANALYSIS

An exact design of the controller depends on the triangular waveform amplitude and frequency parameters noted respectively. The purpose of the proposed controller is to impose a fixed switching frequency to the inverter. As a result, the following expression is always true.

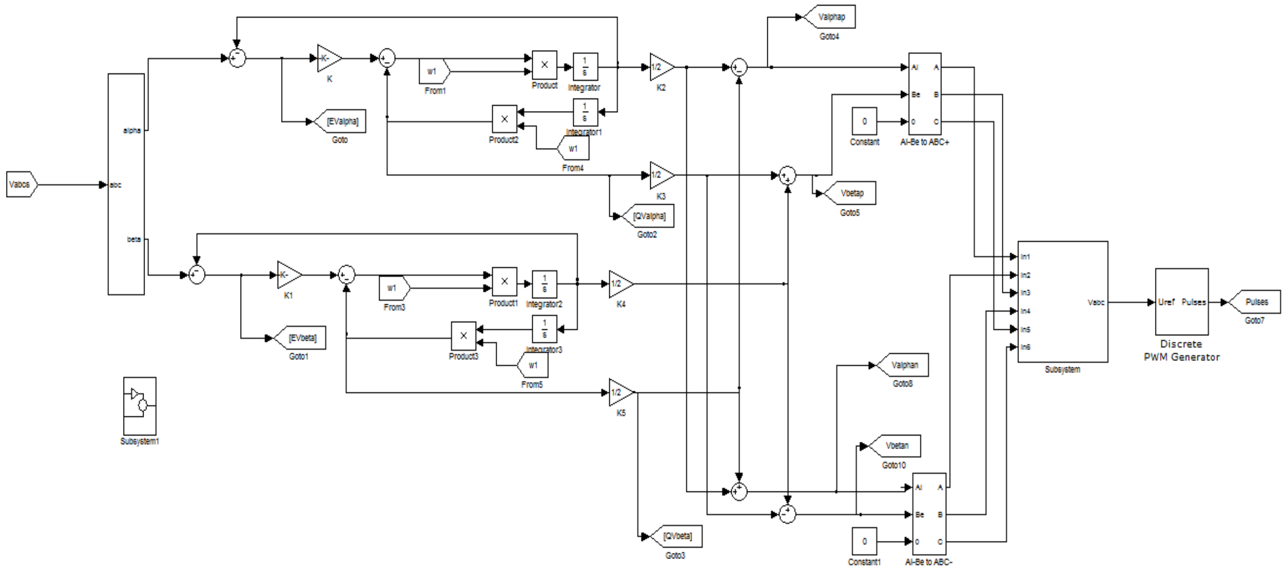

Figure 4.1 Extension of the proposed work

.The extension of the proposed work has given in figure 4.1 and the Extension of Hysteresis PWM Techniques has given in 4.2 figure 4.3 demonstrate the DDSRF model result analysis and comparison waveforms are given in from figure 4.4 to 4.8 in different condition like internal phase problem reduced fault time estimation. a fault circuit with hysteresis has given in figure 4.9

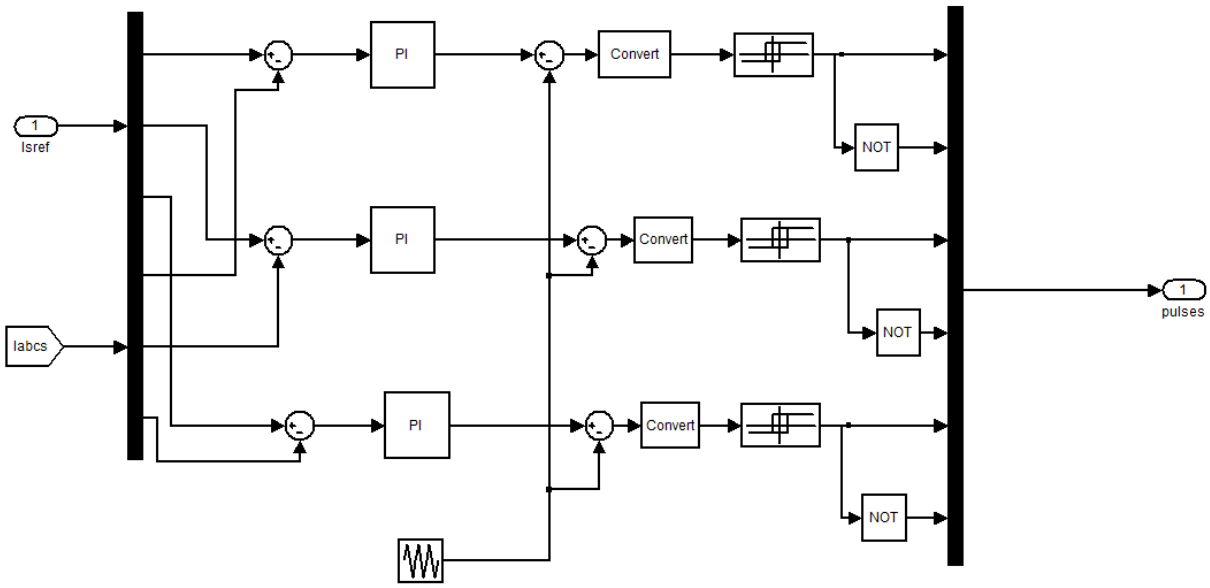

Figure 4.2 Extension Hysteresis PWM Techniques.

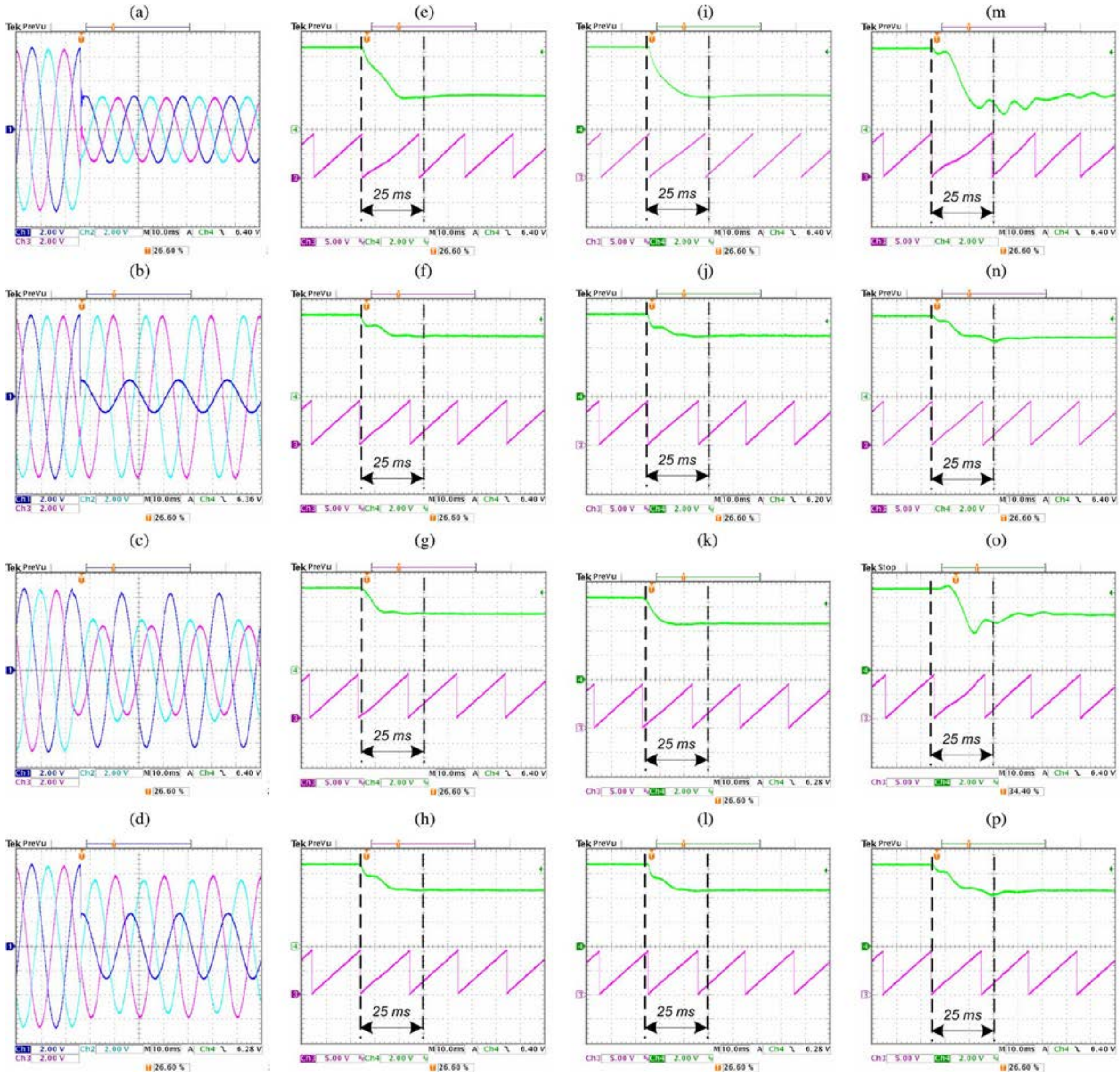

Figure 4.3 DDSRF model.

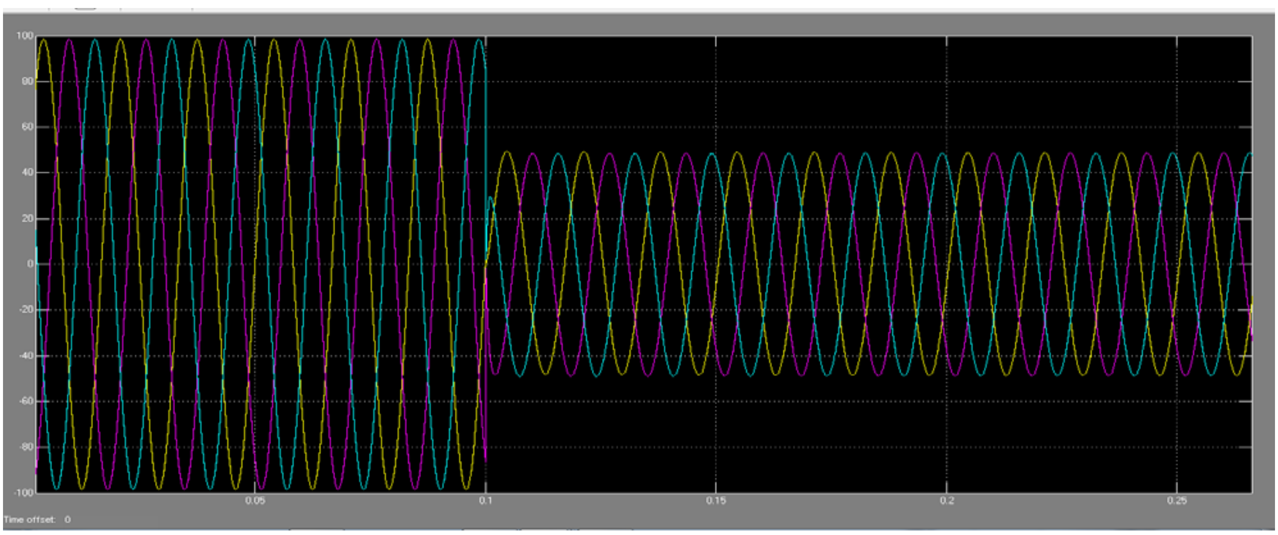

Figure 4.4 No Internal Phase Problem.

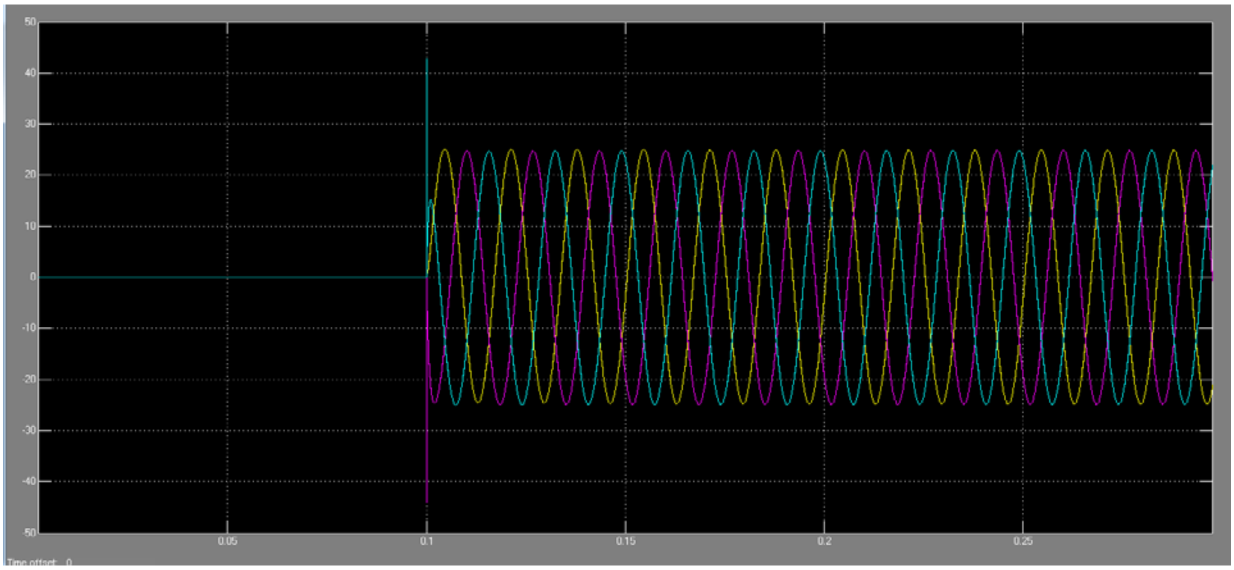

Figure 4.5 Reduced Times for Fault Elimination.

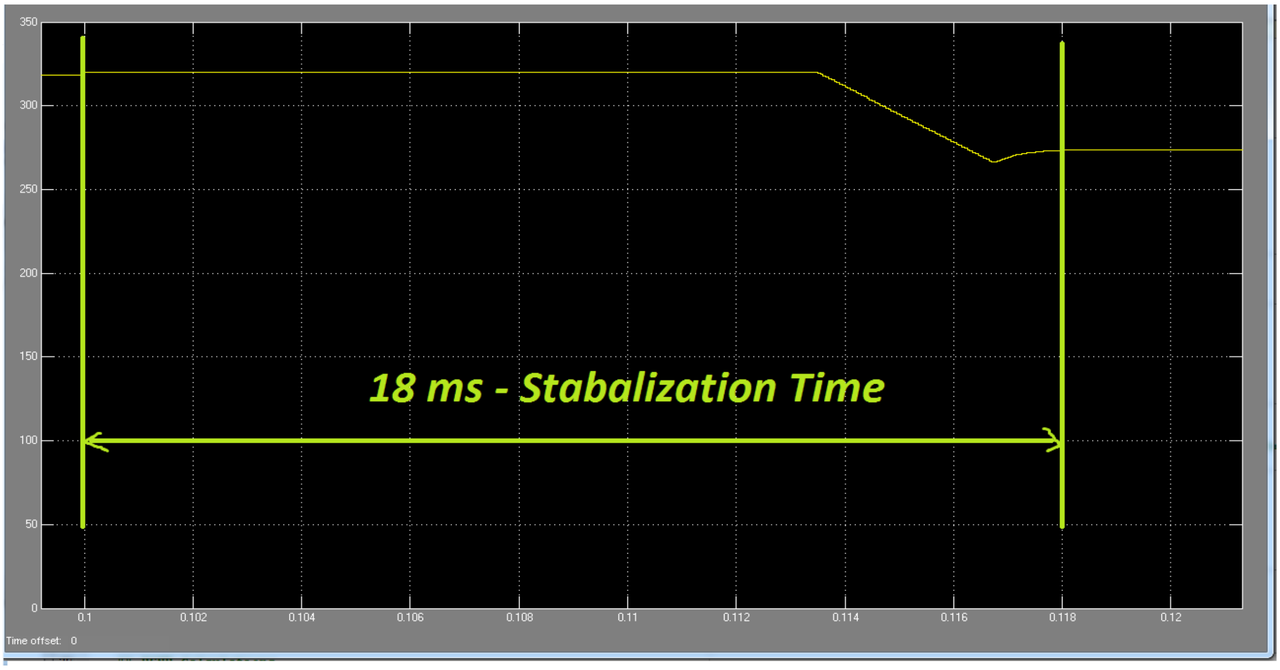

Figure 4.6 Stabilization Time for Synchronization

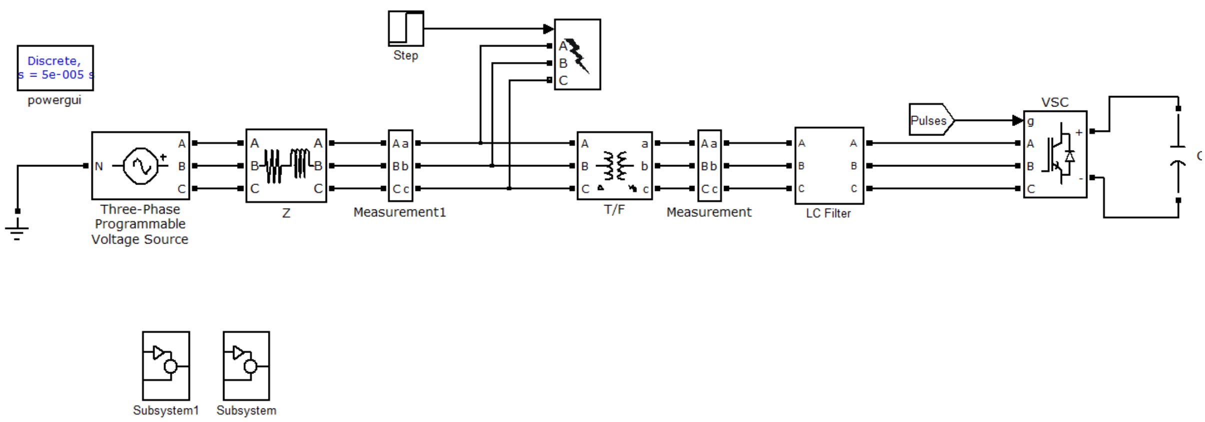

Figure 4.9 Hysteresis With Fault Circuit.

V. CONCLUSION AND FUTURE SCOPE

The research work has proposed and implemented hysteretic is based on the PWM technique which is the most advanced and efficient technique used for the power control mechanism for the distribution generation system of power.Controllability and stabilizability are investigated and synchronization time has to be minimized from 25 ms to 18 ms.Under assumptions, the controllers with fixed sign can steer a hysteretic system towards its equilibrium, without bothering the hysteresis. Fixed sign controllability in the discrete case is possible if and only if the A matrix has no eigenvalues on the positive real axis. In the continuous case fixed sign controllability is possible if and only if A has no eigenvalues on the whole real axis. Also other controllers are investigated: a bang-bang controller and a combination of bang-bang and a low gain: a switched controller. A bang-bang controller assures accuracy but is a trade off with the costs of high input. All these controllers are illustrated with an example. However, some numerical issues arise with a high frequency bang-bang controller and with a switched controller.

REFERENCES

[1] A. Luna et al., "Grid Voltage Synchronization for Distributed Generation Systems Under Grid Fault Conditions," in IEEE Transactions on Industry Applications, vol. 51, no. 4, pp. 3414-3425, July-Aug. 2015.

[2] Y. Li, J. Li, Y. Lei and W. Sun, "Grid synchronization technology for distributed power generation system," 2014 IEEE Conference and Expo Transportation Electrification Asia-Pacific (ITEC Asia-Pacific), Beijing, 2014, pp. 1-6.

[3] S. N. Muneshwar, R. P. Hasabet, P. Kose and A. A. Bhole, "A new adaptive PMU based protection scheme for interconnected transmission network system," 2014 International Conference on Circuits, Power and Computing Technologies [ICCPCT-2014], Nagercoil, 2014, pp. 179-183.

[4] T. A. Youssef, M. Amin and O. A. Mohammed, "Development of high performance improved technique for grid synchronization of WECS," IECON 2014 - 40th Annual Conference of the IEEE Industrial Electronics Society, Dallas, TX, 2014, pp. 5508-5513.

[5] M. Ashabani and Y. A. R. I. Mohamed, "Integrating VSCs to Weak Grids by Nonlinear Power Damping Controller With Self-Synchronization Capability," in IEEE Transactions on Power Systems, vol. 29, no. 2, pp. 805-814, March 2014.

[6] A. Boussaid, Y. Maouche, A. L. Nemmour and A. Khezzar, "A positive and negative sequences detecting method based on an improved PQ theory for power grid synchronization," 2013 8th International Conference on Electrical and Electronics Engineering (ELECO), Bursa, 2013, pp. 181-185.

[7] D. Sharma, B. Sen and B. C. Babu, "Improved grid synchronization algorithm for DG system using DSRF PLL under grid disturbances," 2012 Students Conference on Engineering and Systems, Allahabad, Uttar Pradesh, 2012, pp. 1-6.).

[8] A. Timbus, R. Teodorescu, F. Blaabjerg and M. Liserre,"Synchronization Methods for Three Phase Distributed Power Generation Systems. An Overview and Evaluation," in Proc. 2005 Power Electronics Specialists Conference, 2005. PESC '05. IEEE 36th, pp. 2474-2481.

[9] FANG Xiong, WANG Yue, LI Ming, WANG Ke and LEI Wanjun, “A Novel PLL for Grid Synchronization of Power Electronic Converters in Unbalanced and Variable-Frequency Environment,” Proc. of IEEE International Symposium on Power Electronics for Distributed Generation Systems: pp. 466-471, 2010.

[10] H. Awad, J. Svensson, and M. Bollen, “Mitigation of unbalanced voltage dips using static series compensator,” IEEE Trans. Power Electron., vol. 19,no. 3,pp. 837-846, May 2004.

[11] M. Bongiorno, J. Svensson, and A. Sannino, “An advanced cascade controller for series-connected VSC for voltage dip mitigation,” IEEE Trans. Ind. Appl., vol. 44, no. 1, pp. 187-195, Jan./Feb. 2008.

[12] K. Lima et al., “Doubly-fed induction generator control under voltage sags,” in Proc. IEEEENERGY2030 Conf., Nov. 17-18, 2008, pp. 1-6.