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Reactive power compensation using PV grid

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ABSTRACT

Power systems are complex systems consisting of large number of generating units and interconnected network of transmission lines. The voltage stability, power factor, Harmonics is an issue of prime importance in this complex power system network since the demand for electric power is increasing drastically. The control of reactive power in the transmission lines will enhance the voltage stability of the power system network. This paper presents the design and implementation of the Static VAR Compensator (SVC) in the transmission network for reactive power flow control to improve the voltage stability. The proposed method detects automatically the optimal number of SVCs required for the control of reactive power. The detailed simulation study has been carried out in hardware

Keywords: Power systems, transmission lines, voltage stability, power factor, reactive power, Static VAR Compensator (SVC).

INTRODUCTION

Fault in distribution networks according to its specifications (its location, duration and time) can cause an interruption or a voltage sag at the nodes of the network. By making random faults, the voltage sag in such networks can be investigated. However, the utilization of super conductors in the present scenario is decreased due to its high capable of technology and economic considerations and the components are replaced with the non-super conducting materials. And the main demerits of this non-super conducting coil are it has the power loss which is negligible with the comparison of total power. The other structures which are introduced have two numbers of thyristor switches1, 2 in the AC branch of the diode bridge. Figure 1 show the schematic diagram single line power system which used in this paper. The low voltage side of the substation transformer is Y-connected and is grounded by means of a reactor of 0.01 _ per phase3. This grounding system limits over currents caused by single-phase-to ground faults. The high voltage side of the substation transformer is delta connected. At MV and LV sides of transformer, single line to ground fault (LG), double line to ground fault (2LG), double line to line fault (2L) and three line to line (3L) will be examined and the results can be evaluated [1-5].

Objective

Objective of this project is to maintain voltage Stability, improve power factor and reduce harmonics in the transmission line to reduce losses and to increase efficiency

EXISTING SYSTEM

In existing method PI control only used so its closed loop response is too slow. And not accurate. So voltage stability is low. Here normal PWM is used so harmonics in solid state current limiter is high.

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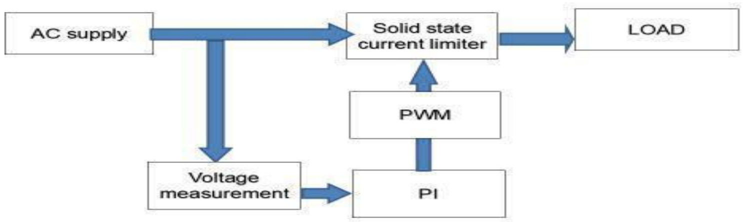
EXISTING BLOCK DIAGRAM



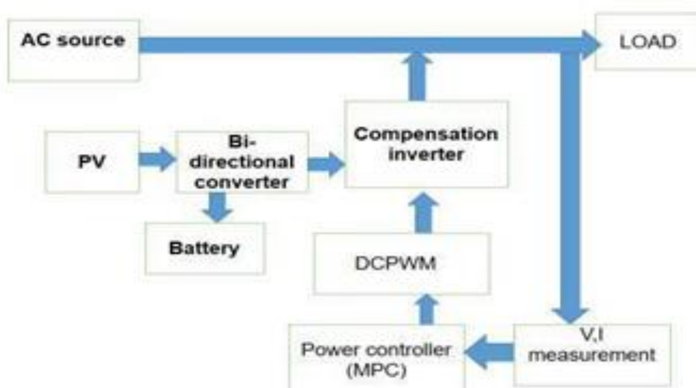
DISADVANTAGE

Transient time for sag rectification is of 10s to 1 minute [6-10].

PROPOSED SYSTEM

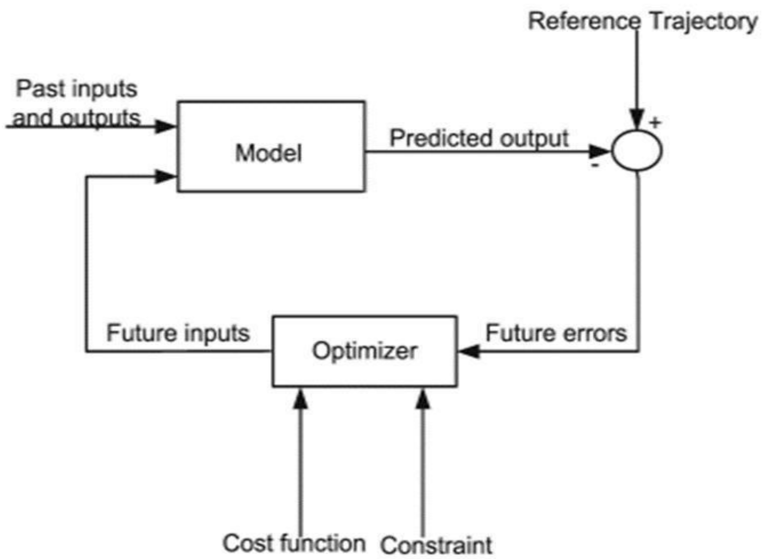
Transient stability time of sag rectification is less than 1ms MPC algorithm is used to calculate fault more accurate and fast so power factor is nearly unity.DCPWM is used so harmonics is less in solid state converter.

Proposed Block Diagram



MODEL PREDICTIVE CONTROL (MPC)

MPC received a very favorable echo in the industry because it is recognized as a simple and effective control technique. It has proved to efficiently control a wide range of applications in industry, among them the chemical process that was the first application for this type of control, petrol industry, electromechanical systems like controlling robot axes and many other applications. It is capable to control a great variety of processes, including systems with long delay times, non-minimum phase systems, unstable systems, multivariable systems, constrained systems and hybrid systems. The main idea of predictive control is to use a model of the plant to predict future outputs of the system. Based on this prediction, at each sampling period, a sequence of future control values is elaborated through an on-line optimization process, which maximizes the tracking performance while satisfying constraints. Only the first value of this optimal sequence is applied to the plant, the whole procedure is repeated again at the next sampling period according to the, receding‟ horizon strategy. A simple block diagram characterizing the MPC is shown in Figure 1. It should be noted that the predicted output from the system model and the actual error are used to obtain the control signal. Model predictive control is based on the system model and the principles of receding horizon control (RHC). The control signal at instant t is obtained by solving, at each sampling instant, an on line open loop optimal control problem over a finite horizon using the current state of the system as initial states. The interesting of this control technique becomes obvious when the trajectory to be followed by the system is known in advance, as for example in the robot, chemical process or machine tools, where the anticipation action takes place. The general object is to tighten the future output error to zero, with minimum input effort. The cost function to be minimized is generally a weighted sum of square predicted errors and square future control values, e.g. in Generalized Predictive Control [11, 12].



Components used

- ATmega8 controller
- IRF840 mosfet
- Potential transformer 230v/12v
- Current transformer 0-10A/0-5v
- AC induction motor 80w/230v
- Inductor capacitor

Power quality problems

Any power problem that results in failure or disoperation of customer equipment, manifests itself as an economic burden to the user, or produces negative impacts on the environment**,** Voltage sags.

Voltage sags are under-voltages on the power system and commonly caused by power failures, downed lines, utility reclosed operations, and storms. They can be corrected by using backup power sources such as UPSs, generators or similar voltage restoration technologies.

Benefits of power quality

Power quality in the container terminal environment impacts the economics of the terminal operation, affects reliability of the terminal equipment, and affects other consumers served by the same utility service

CONCLUSION

An advanced design of VSI for a 3 phase 4 wire distribution systems is proposed in this paper. The proposed system has the capability to mitigate voltage and current related power quality issues with reduced dc link voltage rating. The fuzzy logic controller eliminates the draw backs of MPC controller. MATLAB/Simulink shows the effectiveness of the proposed VSI system. From the results, it is clear that the proposed VSI system can compensate for voltage sag/swell, harmonics in voltage and current waveforms and reactive power, thereby making the load voltage balanced and sinusoidal.

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