[NC-Rase 18]
DOI: 10.5281/zenodo.1489854

ISSN 2348 – 8034
Impact Factor- 5.070

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

POWERFACTOR CORRECTION IN PV GRID USING ADVANCED NEURAL SYSTEMS TO OVERCOME INDUSTRIAL PENALTIES

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ABSTRACT

The performance of a new inverter topology which is analyze and compared with two types of input sources they are solar photovoltaic source and ideal dc source. It is observed that solar panel is connected to inverter,spikes are obtained in output voltage waveform which can be eliminated by adding capacitor of a particular power factor and it should be most favourable with respect to cost ,size and power quality. Diverse quantities like RMS voltage, RMS current, active power, reactive power and total harmonic distortion are measured for the loads having varied power factor. Eventually the results are collate with those obtained by dc battery having same input voltage. By which it is visible that performance of the solar panel in the proposed circuit topology is superior as that of battery. It shows that for 0.8 power factor or above, total harmonic distortion is less however below 0.8 power factor total harmonic distortion, active power, reactive power is high.

Keywords: *Adaptive fuzzy logic controller, power factor, reactive power, solar PV system , total harmonic distortion (THD).*

I. INTRODUCTION

Renewable energy resources are becoming universal day by day due to the depletion of conventional fuel sources and their negative impacts on the environment .So the remedy for this issue is solar energy, whose aim is to convert the energy stored in PV(photovoltaic)array into electrical energy. The PV arrays do not generate any toxic elements that pollute the environment and have long life with low maintainence. As per the evolution in photovoltaic technologies the efficiency of PV arrays is improved .Therefore, studies on PV system increased systematically. The utilization of multilevel inverters have received increasing interest for power conversion in higher power appliances due to their lower harmonics ,higher efficiency and lower voltage stress as compared to two level inverters. Multilevel inverters generate a staircase waveform for the output voltage.

So the harmonic content and therefore total harmonic distortion are reduced .Therefore by increasing the level number high quality output is produced. Thus resulting output voltage waveform move closure to the sinusoidal shape also voltage stress is reduced.in this paper, a single phase multilevel inverter is introduced. This structure can be easily adapted to any number of levels.In distribution power system aproposed control design of grid connected PV system for power factor correction is mentioned.

During low radiation day and night the PV system act as reactive power compensator .This helps PV grid to maintain voltage stability during high reactive loads, also during high radiation at the day time the PV system can supply reactive power to the load. As result active power decreases due to maximum inverter current limits. This introduced system is tested under varied conditions. So it is observed that the proposed system is capable of power factor correction.

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II. CONVENTIONAL METHODS OF POWER FACTOR CORRECTION AND REACTIVE POWER COMPENSATION

1. Capacitor bank method.
2. Automatic power factor correction method.
3. Sychronous condenser method
4. Phase advancer method

III. LITERATURE SURVEY

The paper has suggested and explained a topology for single phase two wire,PV system for power factor correction. Charger controller is proposed along with boost converter.DSP controllers with PV system is used with and correction algorithm to obtain a unity power factor at utility side.

For safety and reliable grid PV system, inverter technology is very important. It also generates high quality power to AC system with effective cost. The requirement are meet with the help of power electronics technology, which are applied to PV system. There is reduction in high harmonic distortion by means of high frequency switching of semiconductor devices with PWM (pulse width modulation) technology.

The power quality is improved by continuous surveillance of the load power factor. When line current is increased, probably the power factor gets reduced beyond the required range thus, higher is the voltage drop also line loss occurs .At such circumstances, capacitance of required value is added whose value can be calculated by mathematics .Thus, the calculated value is approximate to the standard value of capacitor .Microcontroller will switch all the capacitors,which taken together is very close to the capacitance. Due to varying climatic conditions, solar irradiance occurs and to meet faster to its response a control system is equipped to the PV solar grid connected inverters. Now at different solar irradiances the steady state performance of PV grid connected inverter system is mentioned.The system model introduced here is constructed on matlab which includes synchronized control system of PV inverter and utility grid, utility grid connected to 3-phase three level electronic power inverter, DC-DC boost converter connected to maximum power point tracking(MPPT) and PV array with modified perturb. The naturally occurring, theoretically inexhaustible source of energy, such as biomass, solar, wind ,tidal ,and hydroelectric power .They are capable of regeneration of energy, pollution free. Comparatively,PV systems are clean and unobtrusive. This paper presentsDC-DC boost converter with maximum power point tracking where, the maximum electromagnetic waves are extracted from the sun and transferred to the grid where,the output voltage of solar panel is boosted by converter and is controlled by (MPPT).Then ,flow of electricity between loads and grid is controlled by a major component known voltage source inverter further it is transferred to the grid[1][2].

The capacitors in the circuit are charged by power converter .Then , seven level inverter is proposed in this paper to which input voltage source is applied by capacitor where output current waveform is sinusoidal and in phase with grid voltage. Here ,power electronic switches are used which are feasible rather than traditional multilevel inverter.The optimization of 100kw grid connected solar photovoltaic system with the analysis of technique, finance and design is performed at the diverse region of Bangladesh with the co-ordination of RET screen.(software developed by govt.of Canada for energy management) along with NASA's data available for location.The amount of energy generated by solar grid depends upon the slope and azimuth of the of the solar panels affects the absorption of solar radiation which results in electricity generated. Bangladesh is one of the Asian country which includes various six division of solar panel units also the amount of energy in which CHITTAGONG district is leading. This paper also proposes adaptive fuzzy logic controller which is connected to the synchronous motor. The characterstic of synchronous motor is that it generates three type of power factor they are lagging ,leading, and unity as industries are generally based on inductive load so most probably reactive power is generated resulting , lagging power factor which is overcome into leading one by means of fuzzy logic controller. The illustrative diagram proposes the operation of fuzzy logic controller with PV grid system and thus improves the power factor for industries innovatively.[4]

ISSN 2348 – 8034
Impact Factor- 5.070

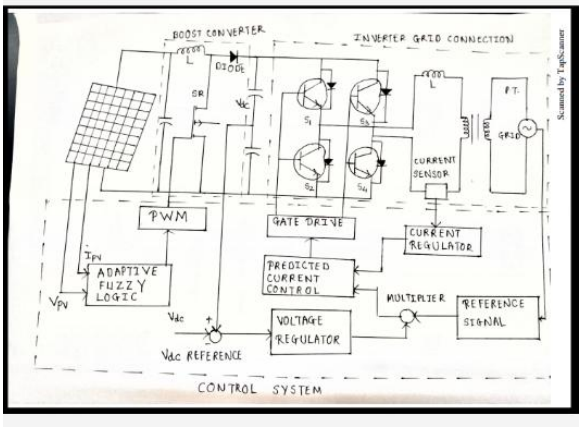

Fig1:-PV grid with multilevel inverter and neuro system.

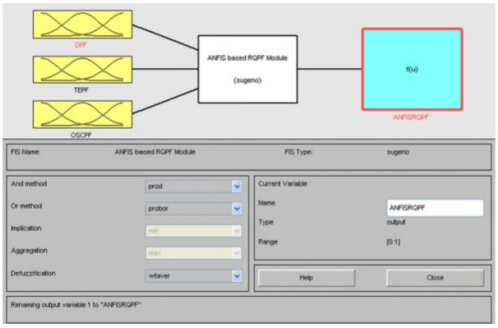

Fig 2. Schematic diagram of ANFIS based RQPFmodule

In , a fuzzy-based representative quality power factor (RQPF) is introduced. The RQPF evaluates a power factor index as a single value that represents the three power factors identified earlier, namely the displacement, transmission efficiency and oscillation power factors. The fuzzy-logic-based approach calculates the RQPF using the Mamdani's fuzzy inference system (FIS). An ANFIS based total demand distortion factor for power quality evaluation is proposed . An ANFIS based method for determination of available transfer capability is proposed to determine the step length of Homotophy continuation power flow method by considering the values of load bus voltage and change in load bus voltage. In this paper, an ANFIS based RQPF is introduced. The RQPF evaluates a power factor index as a single value that represents the three power factors identified earlier, namely the displacement, transmission efficiency and oscillation power factors. An ANFIS based approach is proposed to calculate the RQPF. The advantages of using the ANFIS are simplicity, ease of application, flexibility, speed and ability to deal with imprecision and uncertainties. The proposed approach is tested for linear and nonlinear loads supplied from sinusoidal and non-sinusoidal sources, while considering lagging and leading power factors. The proposed ANFIS based RQPF can be successfully applied for evaluating the power quality, while considering distorted waveforms. The proposed RQPF can represent an essential ANFIS module in that application for evaluating the power factors, while aggregating it with other modules outputs such as total voltage harmonic distortion and total demand distortion. The ANFIS based module used for calculating the ANFIS RQPF is explained . The simulation results for applying the ANFIS based module to different cases are presented. Effectiveness of an ANFIS RQPF in precise billing of customers is discussed . Adaptive neuro-fuzzy inference system The objective of an ANFIS is to integrate the best features of fuzzy systems and neural networks. The ANFIS utilizes ''Representation of prior knowledge into a set of constraints (network topology) to reduce the optimization search space,'' from fuzzy systems and ''adaptation of back propagation to structured network to automate FC parametric tuning,'' from neural networks, to improve performance. The design objective of the fuzzy controller is to learn and achieve good performance in the presence of disturbances and uncertainties. The design of membership functions is

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done by the ANFIS batch learning technique, which amounts to tuning an FIS with back propagation algorithm based on a collection of input–output data pairs. . ANFIS architecture Generally, an ANFIS is a multilayer feed forward network in which each node performs a particular function (node function) on incoming signals. For simplicity, we consider two inputs 'x' and 'y' and one output 'z'. Suppose that the rule base contains two fuzzy if-then rules of Takagi and Sugeno type . Rule 1 : IF x is A1 and y isB1THEN f1 ¼ P1xþQ1yþR1. Rule 2 : IF x is A2 and y is B2 THEN f2 ¼ P2xþQ2yþR2 ð1Þ. An adaptive network is a multilayer feed forward network, in which each node performs a particular function (node function) on incoming signals as well as a set of parameters pertaining to this node. The formulas for the node functions may vary from node to node, and the choice of each node function depends on the overall input–output function which the adaptive network is required to carry out. Note that the links in an adaptive network only indicate the flow direction of signals between nodes; no weights are associated with the links. To reflect different adaptive capabilities, we use both circle and square nodes in an adaptive network. A square node (adaptive node) has parameters, while a circle node (fixed node) has none. The parameter set of an adaptive network is theunion of the parameter sets of each adaptive node. In order to achieve a desired input–output mapping, these parameters are updated according to the given training data and a gradient-based learning procedure is used.

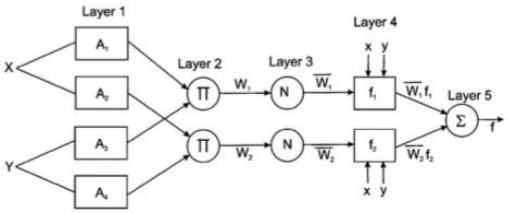

Fig 3. ANFIS architecture

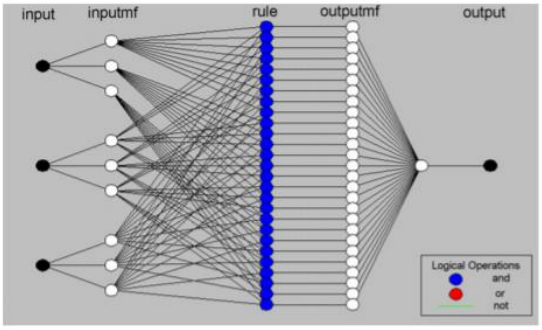

Fig. 4 ANFIS structure.

From the ANFIS structure shown in Fig. 4, it has been observed that when the values of the premise parameters are fixed, the overall output can be expressed as a linear combination of the consequent parameters. The hybrid learning algorithm is a combination of both back propagation and the least square algorithms. Each epoch of the hybrid learning algorithm consists of two passes, namely forward pass and backward pass. In the forward pass of the hybrid learning algorithm, functional signals go forward up to layer 4 and the consequent parameters are identified by the least squares estimate.

IV. RESULT

Thus, power factor of system is maintained upto required value at varying environmental conditions.

ISSN 2348 – 8034
Impact Factor- 5.070

V. CONCLUSION

The proposed system controls the (AC) current of the sync- hronous motor which delivers reactive power (Var) by using adaptive fuzzy logic controller hence, obtaining efficient power factor for industries During humid,cold atmospheric conditons in day and night the PV system acts as a reactive power compensator to maintain voltage stability during high reactive loads.

VI. ACKNOWLEDGEMENTS

The authors of this paper gave their heartiest thanks to our Honourable Principal Dr.C.M.Jadhao, HOD of EXTC Dept. PROF.S.S.Mhaske, Academic Co-ordinator Prof.. A. S. akad ,Prof.M.M. Patil,Prof M.M.Tayade,Asst. Professors of MGI-COET, Shegaon

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