AN ENHANCED FUZZY GRID CONNECTED SYSTEM

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Abstract: In today's distribution grids the amount of distributed generation (DG) units is increasing quickly. This paper describes the ability management ways of a fuzzy controlled grid connected hybrid electrical phenomenon and electric cell distributed generation system with battery as energy device. the first supply of energy for the hybrid distributed generation system is from cell, electric cell and also the battery acts as a complementary supply of energy. The hybrid distributed generation system is connected to a grid through power electronic interfacing devices. A Mat lab/Simulink model is developed for the grid connected hybrid distributed generation system and fuzzy controlled power electronic DC/DC, DC/AC converters to regulate the flow of power on either side. Hybrid fuzzy model is additionally developed for this paper. Simulation results illustrate the performance of the hybrid system following the load demand and operative the system with fuzzy and hybrid fuzzy controller.

Keywords - PV cell, Fuel Cell, Battery, Distributed Generation, MPPT, Fuzzy Control, Hybrid Fuzzy Control.

I INTRODUCTION

Today, new advances in technology and new directions in electricity regulation encourage a major increase of distributed generation resources round the world. This electricity infrastructure in most countries consists of bulk centrally placed power plants connected to extremely meshed transmission networks. However, a replacement trend is developing toward distributed energy generation, which suggests that power conversion systems are going to be set on the brink of energy shoppers and therefore the few massive units are going to be substituted by several smaller ones. one in every of the prevailing different sources of electrical power is that the electric cell (FC).Fuel cells have attracted abundant attention as AN economical, scalable, low-pollution means that of generating electric power.However, restricted by their inherent characteristics, cherish an extended start-up time and poor response to instant power demands, hybrid fuel cell/battery power generation systems are conferred to achieve the high power density of batteries with the high energy density of fuel cells. star (photovoltaic, PV) energy could be a major renewable energy supply at the forefront of standalone and distributed power systems.PV power systems ar but obsessed on weather conditions and their output depends on the time of year, time of day, and therefore the quantity of clouds. union of electric cell with PV can so kind a really reliable distributed generation wherever the electric cell acts as make a copy throughout low PV output. The slow dynamics of the electric cell are often paid by adding battery energy storage. If a electric cell was connected to a step increase in load, it might give this, however the voltage may instantly drop off the V-I curve and therefore the electric cell would take many seconds till it begins feeding the desired power. within the mean solar time, the electric cell is also starved of fuel that isn't smart for the electro catalyst shortening its life.In this paper nucleon exchange membrane electric cell was used. MPPT could be a technique used usually with wind turbines and electrical phenomenon (PV) star systems to maximise power extraction underneath all conditions. though alternative energy is especially lined, the principle applies usually to sources with variable power. star cells have a posh relationship between temperature and total resistance that produces a non-linear output potency which may be analyzed supported the I-V curve. during this paper MPPT was management led by exploitation fuzzy management and hybrid-fuzzy control. to cut back the disturbance in dc output voltage hybrid-fuzzy management is employed. The hybrid system is connected to load and grid through dc/ac convertor. Dc/ac convertor is controlled by exploitation mathematical logic controller.

II. SYSTEM STRUCTURE

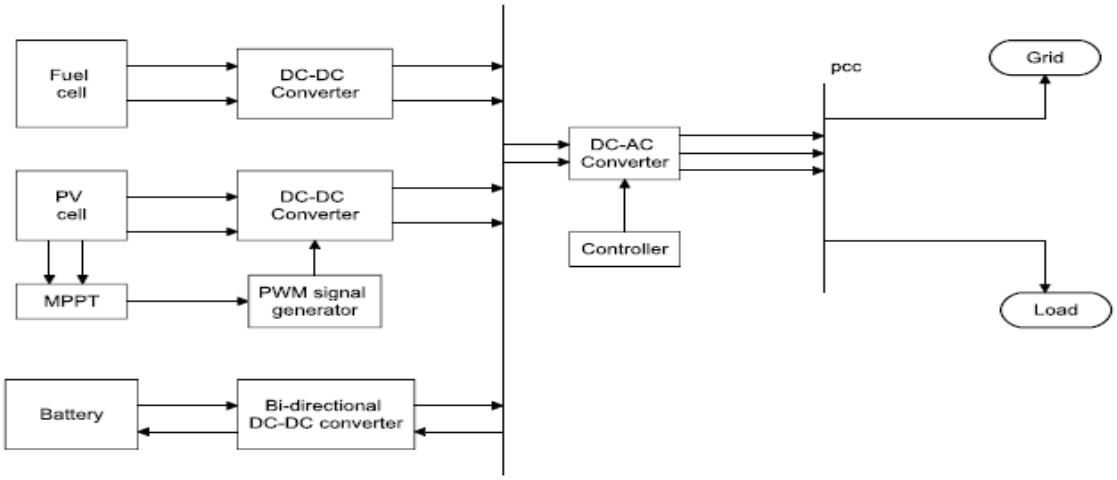

Fig 1: Basic diagram of Grid Connected Hybrid System

The higher than Fig one shows that basic diagram of grid connected hybrid system. It consists ofPV/PEMFC/BATTERY hybrid supply with grid connected. Here electric cell and PV cell ar primary supplys and battery is employed as complementary source of energy

2.1) Fuel Cell:

A electric cell is Associate in Nursing chemical science cell that converts the energy from a fuel into electricity through Associate in Nursing chemical science reaction of atomic number 1 fuel with O or another oxidiser. They show nice promise to be a crucial metric weight unit supply of the long run thanks to their several blessings, similar to high potency, zero or low emission (of waste product gases), and versatile standard structure. Fuel cells ar totally different from batteries in requiring

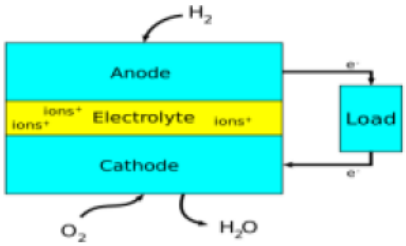

Fig 2: Fuel cell connected to load

In this nucleon exchange membrane cell was used. The solution for this cell is chemical compound membrane (ionomer).The qualified power is within the vary of 1w-500kw. Potency of this cell is 50%-70%. PEM fuel cells operate a relatively low temperatures, around 80°C (176°F). Low-temperature operation permits them to start out quickly. The cell stack is connected to dc-dc boost convertor to spice up the voltage supported load utility. At bound conditions, dc output voltage from cell wasn't met the load demand. At that case, dc-dc boost convertor can work.

2.2) Electrical phenomenon Cell:

A solar cell (PV cell) could be a specialized semiconductor that converts light into DC (DC). Some PV cells can even convert infrared (IR) or ultraviolet (UV) radiation into DC electricity. Electrical phenomenon cells area unit Associate in Nursing integral a part of solar-electric energy systems, that are getting more and more necessary as different sources of utility power. The subsequent shows that equivalent circuit model.

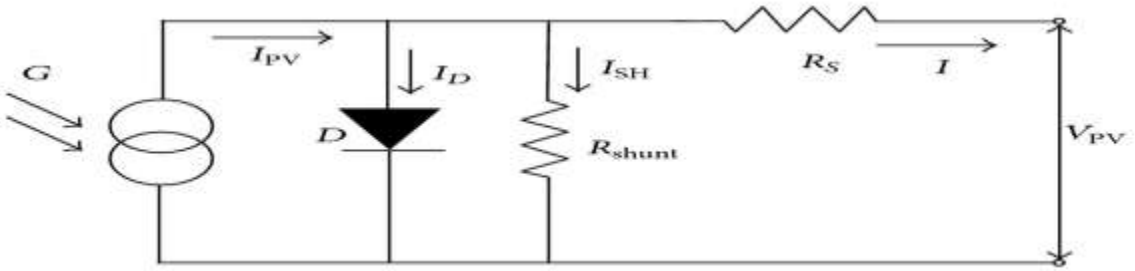

Fig 3: The equivalent solar cell model with Rs and Rsh

G – Solar irradiance ,D – Diode, Rsh – Shunt resistance, Rs – Series resistance, Vph – PV cell voltage, Iph – PV cell current,Id – Diode current, Ish – Current in Shunt resistance, Is – Current in series resistance.

Solar PV has specific benefits as AN energy source: once put in, its operation generates no pollution and no inexperienced house gas emissions. It shows straightforward quantifiability in respect of power desires and semiconductor has massive availableness within the Earth's crust. PV systems have the main disadvantage that the facility output relies on direct daylight, thus concerning 10-25% is lost if a pursuit system isn't used, since the cell won't be directly facing the sun in any respect times. Dust, clouds, and alternative things within the atmosphere additionally diminish the facility output. thanks to these disadvantages most electrical outlet pursuit is employed. during this MPPT, there ar several techniques on the market. Here, to trace most power fuzzy mppt management was used. The output from mppt management was given to dc-dc device through pulse breadth modulation. The pwm controls the duty magnitude relation of GTO switch in dc-dc boost device.

2.3) Battery Modeling:

Batteries convert energy on to voltage. electric battery consists of some variety of voltaic cells. Each cell consists of 2 half-cells connected asynchronous by a semiconducting solution containing anions and cations. One 0.5 cell includes solution and therefore the negative conductor, the conductor to that anions (negatively charged ions) migrate; the opposite half-cell includes solution and therefore the positive conductor to that cations (positively charged ions) migrate. Oxido reduction reactions power the battery. Cations area unit reduced (electrons area unit added) at the cathode throughout charging, whereas anions area unit oxidized(electrons area unit removed) at the anode throughout charging. throughout discharge, the method is reversed. The electrodes don't bit one another, however area unit electrically connected by the solution. Some cells use totally different electrolytes for every half-cell. A centrifuge permits ions to flow between half-cells, however prevents compounding of the electrolytes. the subsequent fig shows the battery model supported voltage model.

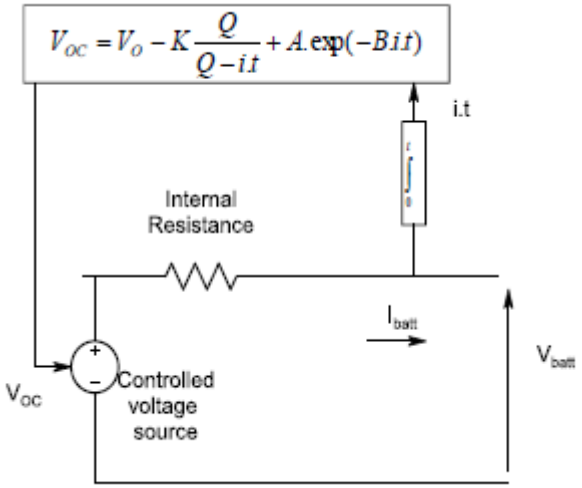

Fig 4: Battery Model

Here is employed as complementary supply. Battery model is connected to bi-directional dc-dc device. Whenever the provision doesn't meet the load demand. Battery can provide power to the load. Whenever the provision is over the utility, at that condition battery can stores the energy.

2.4) Dc-Dc Boost Converter:

Power for the boost device will return from any appropriate DC sources, resembling batteries, star panels, rectifiers and DC generators. A method that changes one DC voltage to a unique DC voltage is termed DC to DC conversion. A boost converter may be a DC to DC device with AN output voltage larger than the supply voltage. a lift device is some times called a change of magnitude device since it "steps up" the supply voltage. Since power (P=VI) must be preserved, the output current is lower than the supply current. The subsequent fig shows the dc-dc device model.

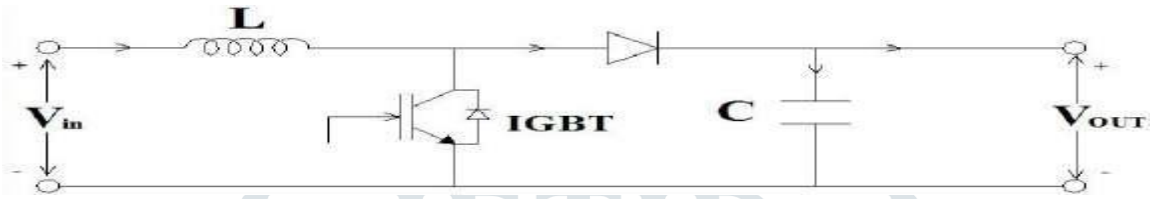

Fig 5: Dc-Dc boost converter model.

The Dc-Dc boost converter model consists of one switching device IGBT. It will turn and turn off based on gate signal D provided. The gate signal D will be given by fuzzy controller.

2.5) Dc/Ac Inverter Model :

The outputs coming from all the sources are in dc. In order to convert the output of dc into ac, Dc/Ac inverter model was used.

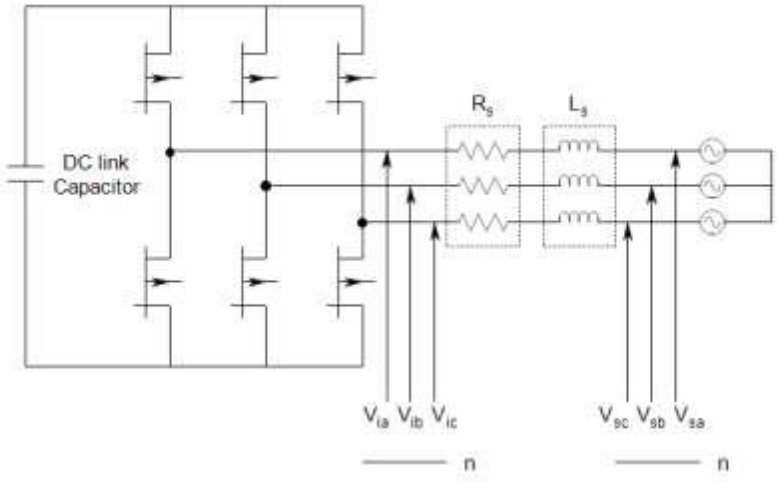

Fig 6: Dc/Ac three phase inverter

A power electrical converter, or electrical converter, is associate device or electronic equipment that changes DC (DC) to AC (AC).The input voltage, output voltage and frequency, and overall power handling rely upon the planning of the precise device or electronic equipment. The electrical converter doesn't turn out any power, the ability is provided by the DC supply. The dynamic model of the voltage supply electrical converter (VSI) is employed. The VSI are going to be controlled by sing fuzzy controller.

III. FUZZY CONTROLLER

A fuzzy system could be a system supported formal logic a mathematical system that analyzes analog input values in terms of logical variables that defy continuous values between zero and one, in distinction to classical or digital logic, that operates on separate values of either one or zero. The input variables in an exceedingly fuzzy system ar generally mapped by sets of membership functions like this,

called "fuzzy sets". the method of changing a crisp input price to a fuzzy price is named "fuzzification". The membership functions ar with seven linguistic variables sush as, negative massive, negative medium, negative tiny, zero, positive tiny, positive medium, positive massive. Fuzzy management supported rules. In reasoning engine fuzzy sets are going to be taken as input and information based mostly rules ar written. during this mamdani technique is employed. It consists of 49 rules within the kind if/then.

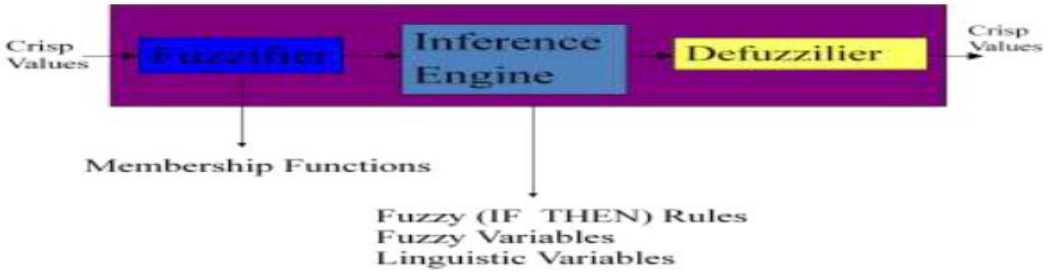

Fig 7: Basic fuzzy control diagram

The higher than fig shows the fundamental fuzzy management diagram. victimization these forty nine rules supported membership operate, fuzzy management are going to be done. Afterward defuzzification method are going to be carried. Fuzzy sets into knowledge sets. By victimization input and output membership functions and rules, the error in voltage are going to be changed. during this paper, fuzzy management was employed in MPPT, Dc-Dc boost device and Dc/Ac electrical converter. This fuzzy management is data primarily based

IV. HYBRID FUZZY MANAGEMENT

Hybrid fuzzy management is that the simplest management compared to fuzzy management. the target of the hybrid controller is to utilize the simplest attributes of the PI and formal logic controllers turn out} a controller which can produce higher response than either the PI or the fuzzy controller. There area unit 2 major variations between the chase ability of the traditional PI controller and also the formal logic controller. each the PI and fuzzy controller turn out moderately sensible chase for steady state or slowly varied operative conditions. However, once there's a step modification in any of the operative conditions, reminiscent of could occur within the point or load, the PI controller tends to exhibit some overshoot or oscillations. The fuzzy controller reduces each the overshoot and extent of oscillations beneath an equivalent operative conditions. though the fuzzy controller includes a slower response by itself, it reduces each the overshoot and extent of oscillations beneath an equivalent operative conditions. the will is that, by combining the 2 controllers, one will get the fast response of the PI controller whereas eliminating the overshoot probably related to it. change management Strategy the change between the 2 controllers wants a reliable basis for determining that controller would be more practical. the subsequent shows that basic block delineated illustration of hybrid fuzzy management.

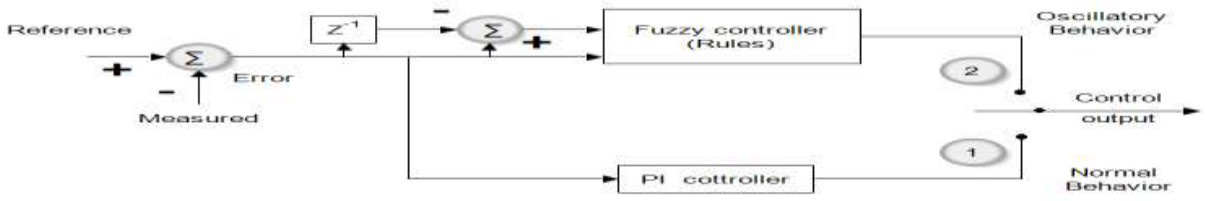

Fig 8: basic diagram of hybrid fuzzy controller

The answer may well be derived by viewing the benefits of every controller. each controllers yield sensible responses to steady-state or slowly dynamical conditions. to require advantage of the speedy response of the PI controller, one must keep the system responding below the PI controller for a majority of the time, and use the fuzzy controller only the system behavior is periodic or tends to overshoot. Thus, once planning the most effective stand alone PI and fuzzy controllers, one must develop a mechanism for change from the PI to the fuzzy controllers, supported the subsequent 2 conditions:

• Switch once oscillations are detected;

• Switch once overshoot is detected.

Here hybrid fuzzy management was utilized in MPPT management. to urge the higher dc output voltage whenever any changes occurred .compared to fuzzy management it's best response in terms of steady-state and peak overshoot. Simulation results illustrate these performances.

V. MATLAB/SIMULINK MODEL

The projected conception of this paper is developed in mat work. the subsequent figure shows the matlab/simulink model

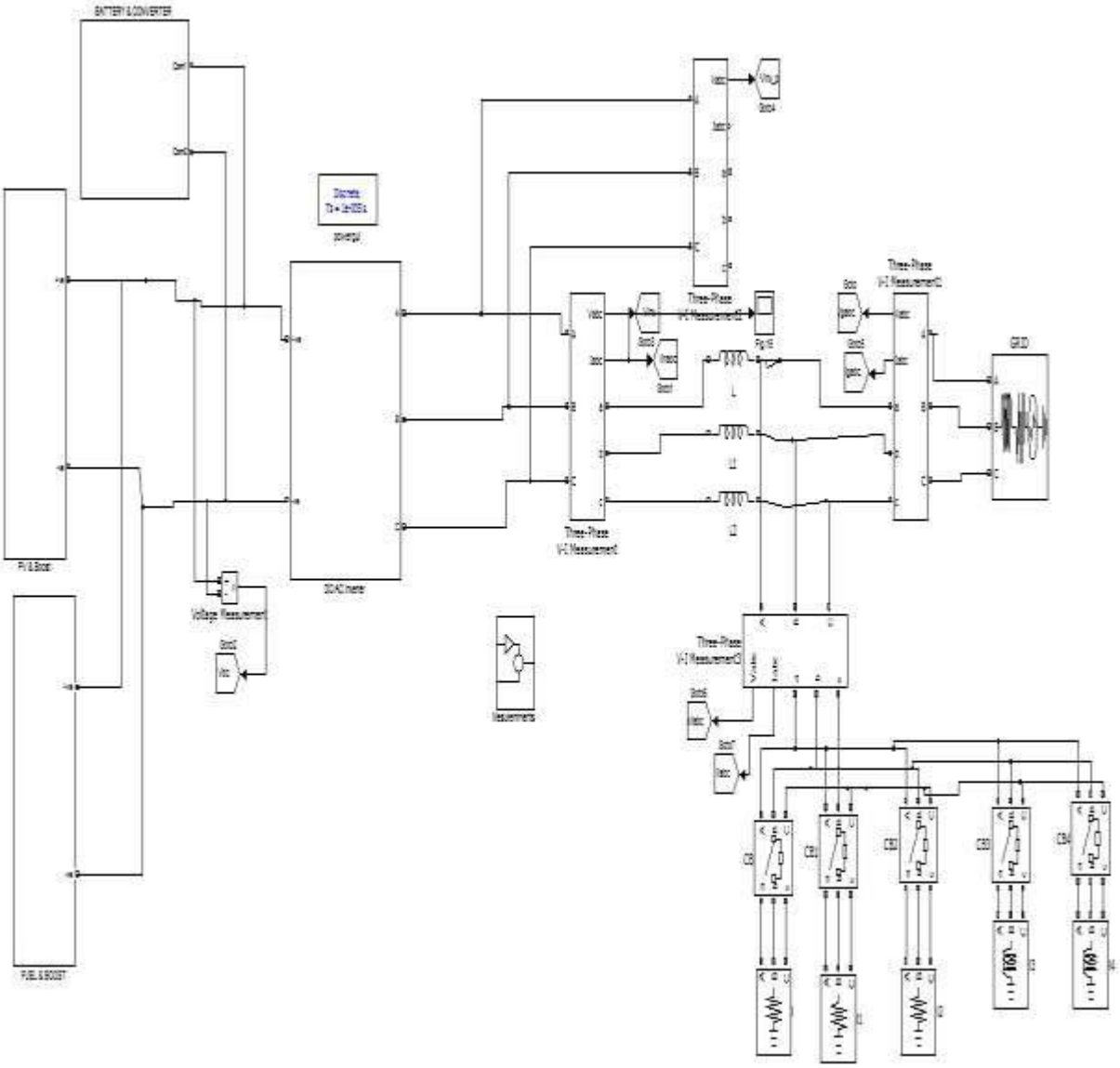

Fig 9: mat lab/simulink model of fuzzy and hybrid fuzzy controlled gird connected hybrid pv/pemfc/battery distributed generation system.

VI. MATLAB/SIMULINK RESULTS

The performances for proposed concept results was carried out and shown below

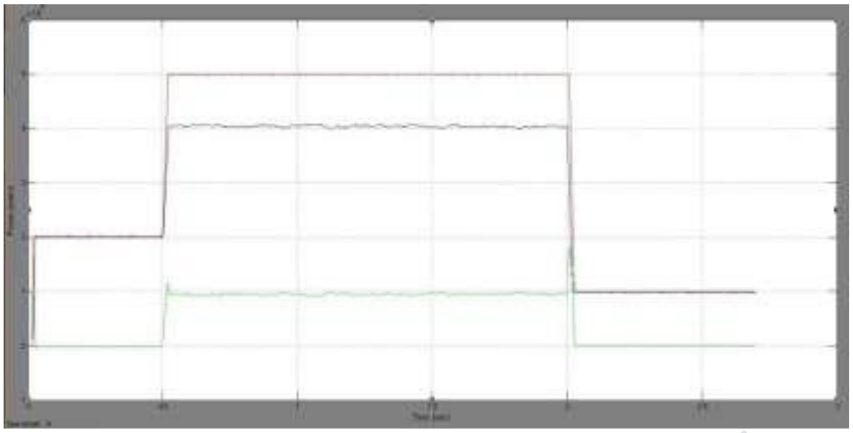

Fig10: simulation results of active,hybrid & grid power

Fig 11: simulation results of reactive load, hybrid power system & grid power

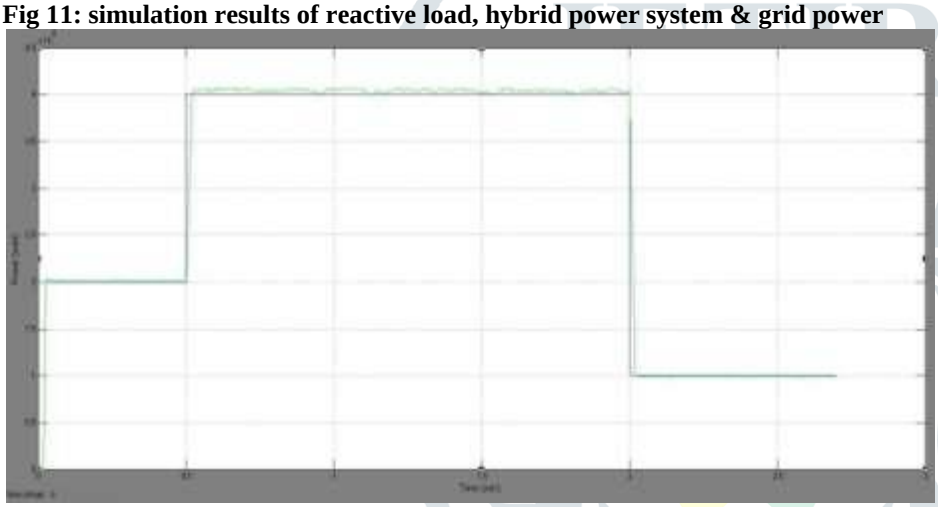

Fig 12: simulation results of hybrid active power & reference active power

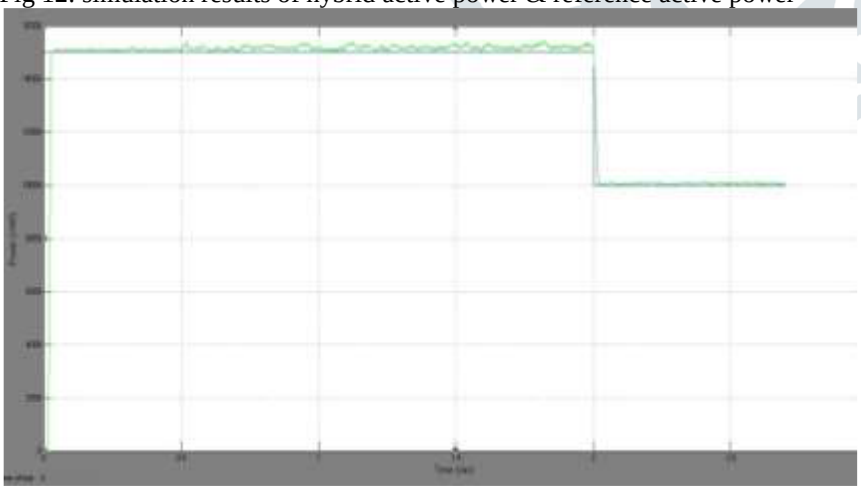

Fig 13: simulation results of hybrid reactive power & reference reactive power

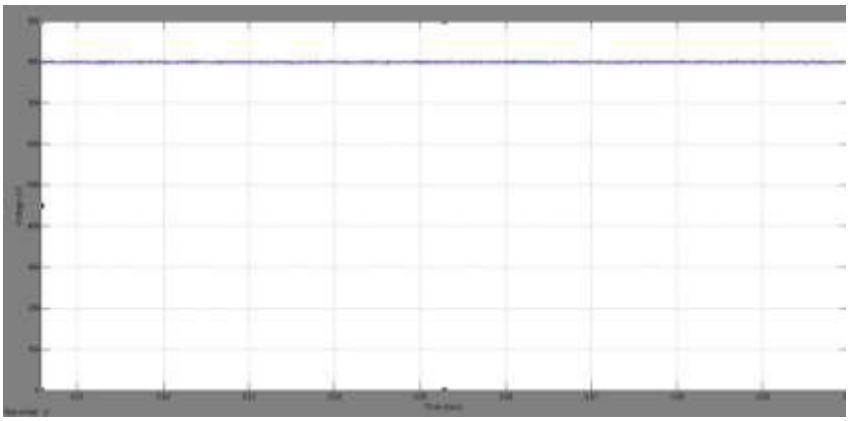

Fig 14: simulation results of battery voltage

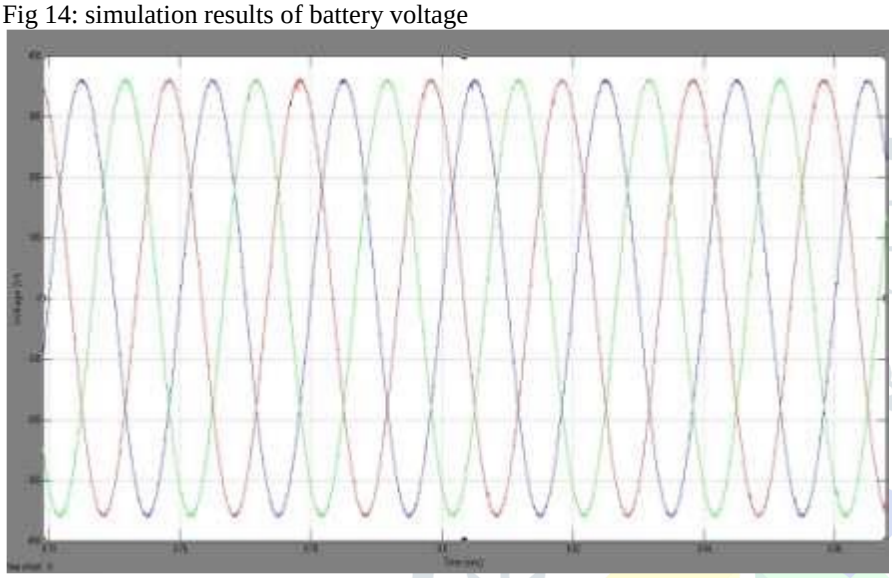

Fig 15: simulation results of voltage at pcc

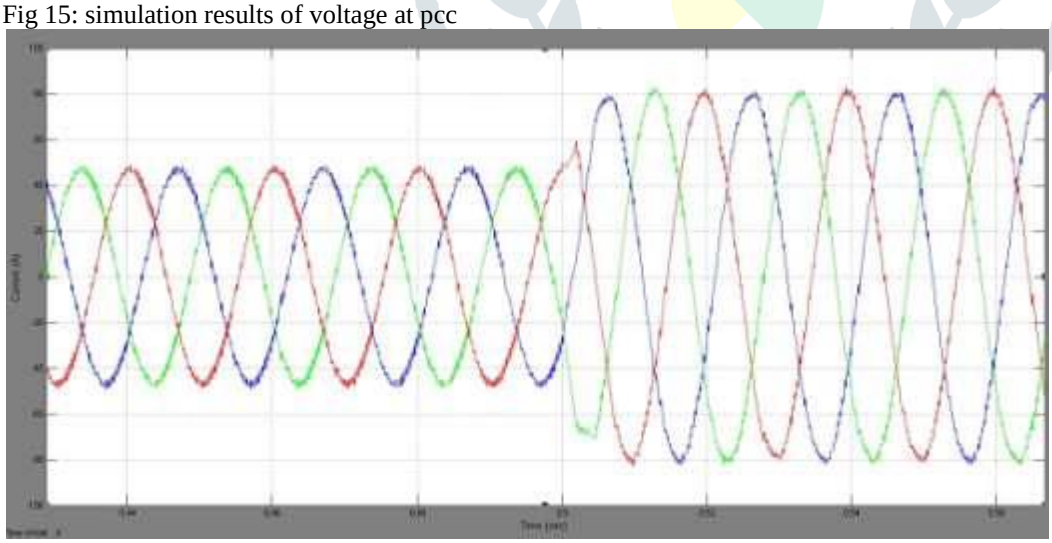

Fig 16: simulation results of currents at pcc

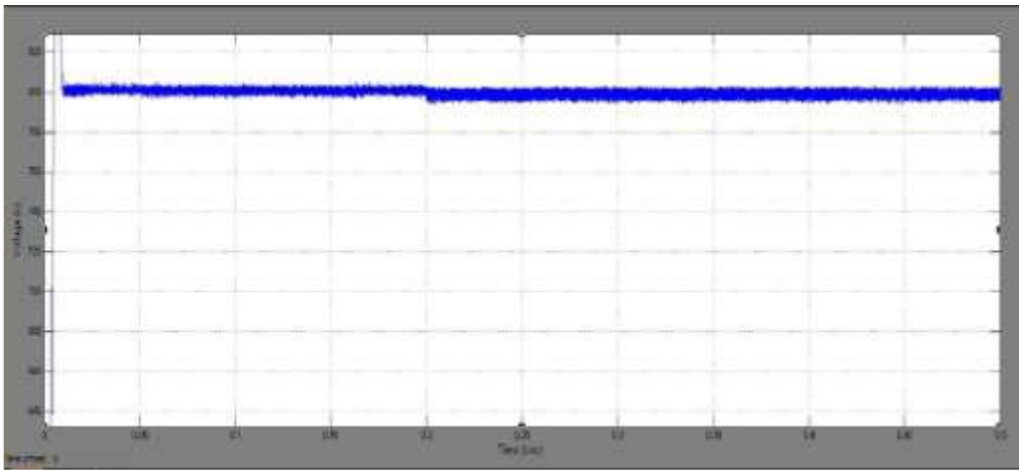

Fig 17: simulation results of dc voltage with hybrid fuzzy at dc sudden load

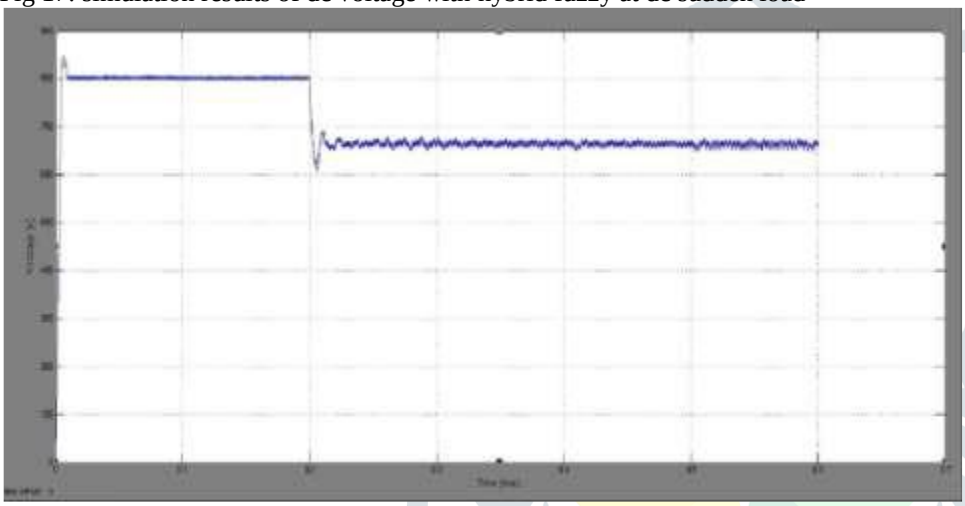

Fig 18: simulation results of dc voltage with fuzzy at dc sudden load

VII. CONCLUSION

The proposed work deals with the power control strategies of a fuzzy controlled grid connected hybrid PV/PEMFC/BATTERY and the output of dc was compared with hybrid fuzzy control. It has better output than fuzzy. It responds to the disturbances and settles down to steady state quickly and less peak overshoot. MATLAB/SIMULINK model results have good response.

REFERENCES

[1] T.praveen kumar,y.chandrasekhar, N.subrahmanyam, M.sydulu," control strategies of a fuzzy controlled grid connected hybrid PV/PEMFC/BATTERY distributed generation system" proceedinds of 2015 IEEE.
[2] Edward J. Coster, Johanna M. A. Myrzik, Bas Kruimer, Wil L.Kling, " Integration issues of distributed generation in distributiongrids" proceedinds of IEEE, January 2011.
[3] M. Hashem Nehrir and C. Wang, "Modelling and Control of Fuel Cells", Wiley, 2009.
[4] C. M. Shepherd, "Design of primary and secondary cells II .An equation describing battery discharge", J. Electrochem. Soc. 112, 657 (1965).
[5] A. Hajizadeh and M. Aliakbar-Golkar "Fuzzy Control of Fuel Cell Distributed Generation Systems" Iranian Journal of Electrical & Electronic Engineering, Vol. 3, Nos. 1 & 2, Jan. 2007.
[6] Golkar M. A. and Hajizadeh A., "Intelligent power management strategy of hybrid distributed generation system,".Journal of Electrical Power and Energy Systems, June 2007.
[7] Amin Hajizadeh, Samson G. Tesfahunegn, and Tore M. Undeland, "Intelligent control of hybrid photo voltaic/fuel cell/energy storage power generation system" J. Renewable Sustainable Energy 3, 043112 (2011); doi: 10.1063/1.3618743.
[8] Loc Nguyen Khanh, Jae-Jin Seo, Yun-Seong Kim, and Dong-Jun Won,"Power Management Strategies for a Grid connected PV-FC HybridSystem" IEEE transactions on Power Delivery, July 2010.