International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)
ISSN: 0976-1353 Volume 24 Issue 8 – MAY 2017.

AN INTERACTIVE OPERATION STRATEGY FOR MICROGRID COOPERATED WITH DISTRIDUTION SYSTEM

SARADHA D[#1] and Dr. SP. UMAYAL[*2]

[#] *Masters Scholar, M.E Department of Electrical Engineering, Muthayammal Engineering College, Rasipuram, India*

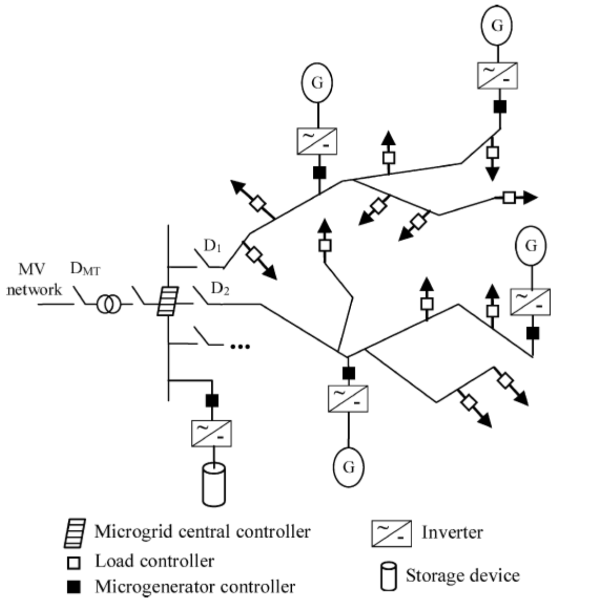
[*] *Dean of EEE, M.E Department of Electrical Engineering, Muthayammal Engineering College, Rasipuram, India*

***Abstract*— Micro grid is an autonomous system which can achieve self-control, self-protection and self-management, In Renewable energy has attracted the interests of researchers all around the world. The major challenge is to combine various existing sources in a single model so as to extract the usefulness of each of them while complementing each other's weaknesses. This paper proposes a method to integrate solar photovoltaic system, wind turbine system and diesel generator Connected to the Loads. In addition, the battery's charge and discharge state can be optimized thanks to the consideration of the battery's depth of discharge (DOD), the charge/discharge current, electricity selling benefits, generation cost of distributed generations (DGs) is proposed. And then an interaction model in which the microgrid responds to the interaction demand through adjusting the scheduling plan aiming at dealing with the excessive peak load of distribution system is presented.A dump load is also connected to the system to absorb the excess power. The hybrid system model has been developed in MATLAB/Simulink. An Adaptive Neuro Fuzzy Inference System (ANFIS) based controller has been designed and the system is analysed in terms of the power generation and consumption.Case study ona grid-connected microgrid test system based on IEEE 13-node distribution feeder demonstrates the effectiveness of theproposed approach in microgrid frequency regulation followingan unplanned islanding event.**

***Index Terms*— Hybrid system, Diesel Generator, and Photovoltaic panel, maximum power point tracking (MPPT)Wind turbine, Active power sharing, ANFIS Control.**

I. INTRODUCTION

Microgrids (MG) have emerged as the enabling engine for the smart grid technologies at distribution level. Microgrids aredefined as active distribution networks consisting of distributed generations (DGs), energy storage systems (ESS), and local loads which can operate in grid-connected mode (normal operation),islanded or autonomous mode (emergency operation)and ride through between two modes. The Micro grid Comprises DERs, ESSs, Loads, Production and Control Devices Which can achieveself-control, self-protection and self-management. IMOHS is different from other version of the multi-objective HS[1] in the improvisation, updating step and saving thenon dominated harmonies at each iteration with additional memory. The salient feature of a microgrid is its ability to be islanded from them a in power distribution network. Islanding is typically performed to rapidly disconnect the microgrid from a faulty distribution network to safeguard the microgrid components from upstream disturbances and allow an uninterrupted supply of loads [2].The microgrid is islanded from the main grid using upstream switches at the point of common coupling (PCC), and the microgrid load is fully supplied using local resources [3].in an interconnected mode, the microgrid is connected to the distribution network, importing or exporting energy or providing ancillary services, working in a coordinated way with the Distribution Management System (DMS)[4][5].



In these cases, the microgrid can operate isolatedfrom the distribution network using local resources, changing frompower control to frequency control and, if necessary, shedding load [6].The operating reserve capacity, the battery's charge/discharge current, the charge/discharge rate and the charge/discharge, the operating reserve capacity can provide a safety margin that helps ensure reliable power supply of the WSB-HPS while the battery's charge/discharge current, rate and cycles can seriously affect the battery's lifetime [7].A strongly fluctuant power injected into the grid will impact on the utility grid [8].Besides, many artificial intelligence (AI) techniques such as neural network technique, fuzzy logic, and neuro-fuzzy system have been proposed to fine tune the PI controller parameters [9].The adaptive neuro fuzzy inference system (ANFIS) combines the neural networks and fuzzy logic and this integration results in the most powerful AI technique [10].

II. SYSTEM MODEL

In this section we consider the existing system design and the proposed system.

A. EXISTING SYSTEM

This project the utilization of a harmony search algorithm (HSA) to optimally design the proportional-integral-derivative controller (PID controller) controllers of a grid-side voltage source cascaded converter with two additional loops for smooth transition of islanding and resynchronization operations in a distributed-generation (DG) system.

The first loop is the frequency-control loopwhich is superimposed on the real power set point of the cascaded controller of the voltage-source converter to minimize the frequency variation during the transition from the grid mode to islanding mode.The second loop is the resynchronization loop which reduces the phase shift of the ac voltages of the DG with the utility grid ac voltages during islanding operationleading to a successful grid reconnection Event.

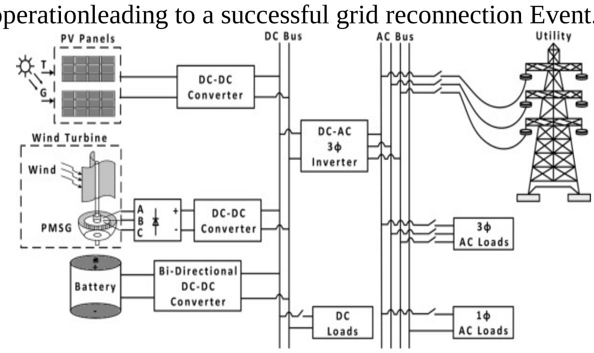


Fig: 4Structure of the Microgrid DG System.

B. Problem Identified:

- Then the relationship between voltage and the loss under different node equivalence modes is analyzed on the all nodes' injection currents are Varies so as to keep the influence of current on loss allocation constantly at different voltage levels.
- The scale of cross-zone renewable electricity trading increases constantly. In addition, the difference between peak and base load increases year by year. As a result, the base-load cycling problem is getting worse. This problem imposes negative impacts on the utilization of renewable energy during the base-load period.
- This Total Problem Overcome The Proposed DG System.

III. PROPOSED SYSTEM

This paper carries out the modeling and simulation of a hybrid system consisting of a solar photovoltaic system, wind turbine generator, diesel generator, and energy storage system (ESS) and loads, demonstrate the effectiveness of the proposed method generation cost of distributed generations (DGs) system. An ANFIS based controller has been designed and the system is analysed in terms of the power generation and consumption.

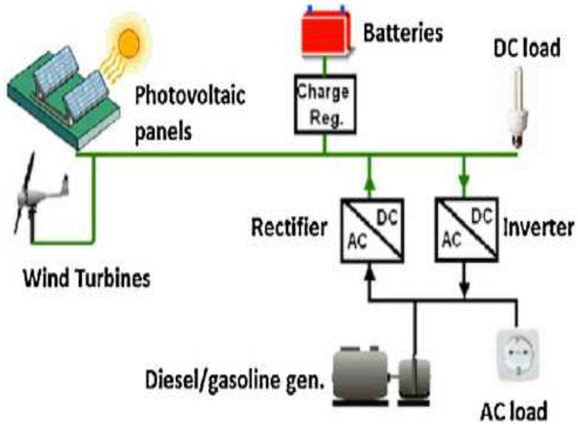


Fig: 5Hybrid System Modelon theANFIS based Micro grid System.

A. Benefits:

- Increase the efficiency of conversion using Active and Reactiveperformance better the output power.
- We used to ensure the right presentation of the ANFIS-based supervisory control system in categorize to assure the power demanded by the grid.
- Using adaptive Neuro-fuzzy inference system for Better Output of Ripple Reduction Load Circuit.
- High power factor on the grid side with low total harmonic distortion (THD).

IV. DESIGN CONSTRUCTION

The proposed model of the PV-Wind-Diesel hybrid system isshown in Fig.5. The mathematical models of the system'scomponents are described as follows:

A. Solar Photovoltaic System

The PV system normally uses solar panels, which is in arrays. There are many types of PV system, starting from a cell up to arrays.

Usually a number of PV modules are arranged in series and parallel to meet the energy requirements. PV modules of different sizes are commercially available (generally sized from 60W to 170W).

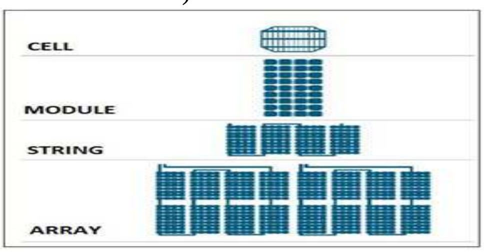


Fig: 6 The PV from cell to module

B. Wind Turbine

It presents a two-blade turbine coupled to a three-phase permanent magnet synchronous generator (PMSG).This WT is represented by a model with the following sub-systems: turbine and generation system.

The generation system is composed of a three-phase

PMSG, rectifier, and converter. Fig. shows the connects the WT to the dc grid, is controlled by a torque reference based Buck Boost control in order to extract the maximum available power from the WT.

C. Diesel Generator

The diesel generator consists of two main parts i.e. generator and a prime mover. The prime mover supplies the power demand at a constant frequency and the synchronous generator helps in keeping the voltage constant at all load conditions. The frequency is maintained at a constant value by keeping the speed of the rotor constant with the governor. The synchronous generator controls the excitation current that in turn controls the output voltage. The variation in the frequency indicates the balance in active power maintained by the governor and the variation in voltage indicates the balance in reactive power maintained through the excitation of the generator.

D. Energy Storage System(ESS)

A lithium-ion battery is a member of family of rechargeable battery types in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging.

E. DC-DC converter switching

The DC-DC converter is considered as the heart of the power supply, thus it will affect the overall performance of the power supply system. Switched DC-DC converters offer a method to increase or decrease an output voltage depend on application or system.

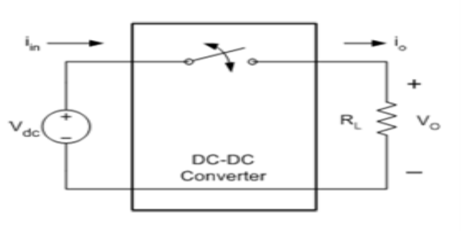


Fig: 7 switching of DC-DC converter

There are two switching condition that need to be applied, that is when ON and OFF as shown in Figure. When ON, Output voltage is the same as the input voltage and the voltage across the switch is 0V. When OFF, Output voltage = 0V and current through the switch = 0A. In ideal condition, power loss = 0W since output power equal to input power.

F. Maximum Power Point Tracking

A typical solar panel converts only 30 to 40 percent of the incident solar irradiation into electrical energy. Maximum power point tracking technique is used to improve the efficiency of the solar panel.By changing the duty cycle of the boost converter appropriately we can match the source impedance with that of the load impedance. The Algorithm MPPT using Perturb & Observe (P&O) is the simplest method. In this we use only one sensor, that is the voltage sensor, to sense the PV array voltage and so the cost of implementation is less and hence easy to implement.

The Perturb & Observe algorithm states that when the operating voltage of the PV panel is perturbed by a small increment, if the resulting change in power P is positive, then we are going in the direction of MPP and we keep on perturbing in the same direction. If P is negative, we are going away from the direction of MPP and the sign of perturbation supplied has to be changed.The flowchart for the P&O algorithm is shown.

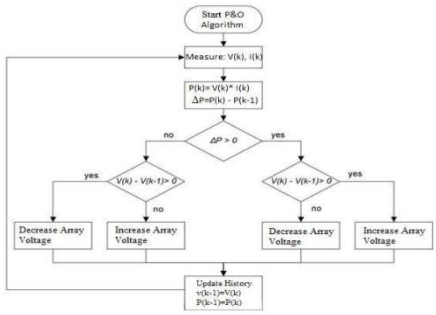


Fig: 6 Flowchart of Perturb & Observe algorithm

G. Designing of ANFIS Based Controller

ANFIS is a graphical network representation of Sugeno-type fuzzy inference systems which have neural learning capabilities.

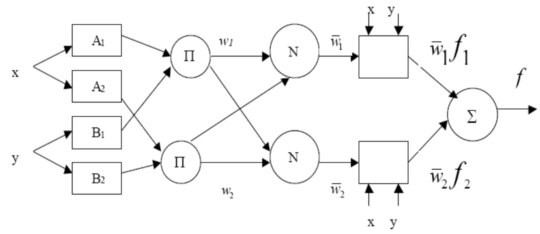


Fig:7Structures of ANFIS

The network has various nodes with specified functions collected in layers. The fuzzy inference system can be trained and tuned with the help of ANFIS. During the training process, the membership functions are optimised on the basis of the input/output data.The structure of the ANFIS network is shown in fig.7. It usually consists of five layers. For designing, the output of the proportional integral (PI) controller is taken as the input training data set for the ANFIS.

TABLE 1: DESIGN SPECIFICATIONS FOR ANFIS CONTROLLER

Number of inputs	1
Number of outputs	1
Number of membership functions	5
Type of membership function	trimf
Number of epocs	60
Error	0.93e-5

H. Algorithm for BESS Agent

The BESS is used for frequency regulation, system reserve, demand-side management capacity, and augmentation of renewable energy resources. In this study, the scheduling algorithm of the BESS is designed using a ANFIS expert system that can obtain an appropriate margin during the day and a real-time operation algorithm is responsible for handling emergency situations.In this study, the scheduling algorithm was designed to determine if it is charging or discharging using the ANFIS system as the input membership functions of the BESS SOC.

The BESS has an agent that receives the electricity price from the MGCC. The agent determines the hourly BESS output using the ANFIS system with the hourly SOC and electricity price. In the scheduling algorithm, the BESS has a driving range of 30% to 100% of the SOC. When the calculated SOC is greater or lower than the operating range, the agent determines the maximum value within the SOC constraints. The defuzzification value from the ANFIS system determines the BESS power output.

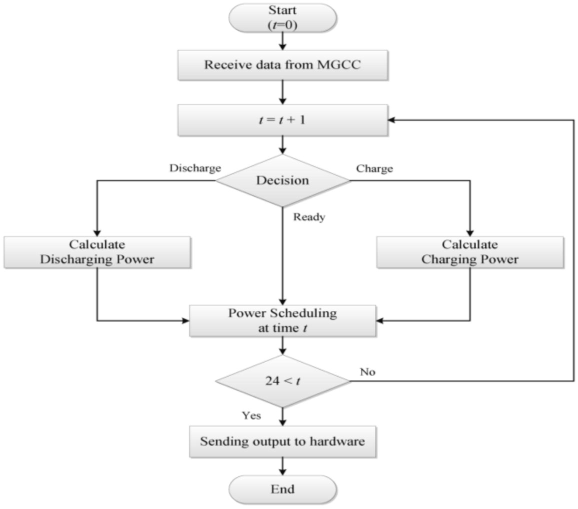


Fig.8 Flow chart of battery energy storage system (BESS) scheduling algorithm.

I. *Hybrid DC- and AC-Coupled Microgrids*

The hierarchical microgrid architecture with DC and AC links. It aims to provide aneffective way to integrate a variety of MG units into existingdistribution system. Hybrid DC- and AC-coupled microgridsuse the DC part for connecting the distributed energy storagesystems including batteries, Diesel Generatorconnected to bidirectional AC-DC converters, and other DCenergy sources like PV systems connected through DC-DCBoost converters and small turbines (wind) connectedthrough rectifiers. A decoupled control of DC and AC partsof microgrid is achieved by using power converters.Although the hybrid DC- and AC-coupled microgrid.

J. *Grid Interaction connection StandardsDistribution System*

Although the hybrid DC- and AC-coupled microgrid concept provides a more flexible approach Active and Reactive Better Output Result.

Performance Parameter	Output
PV	Volt=210v
	Current=7Amps
Wind Mill	Volt=200v
	Current=5Amps
Diesel Generator	Volt=300
	Current=2Amps
ESS	Upper limit SOC=0.9
	Lower limit SOC=0.3
DG	Volt=500v
	Current=3Amps

V. SIMULATION RESULTS

A hybrid system model is developed in MATLAB/Simulink version 10. The controller for the system is designed based on the Adaptive Neuro Fuzzy Inference System with the help of fuzzy logic toolboxes.

There is one local load connected to a DG unit and one common load connected to ac common bus, the microgrid is connected to utility through a static transferswitch (STS) disconnects the micro grid from the main grid, the total power demand of the load is supplied by the DGs.

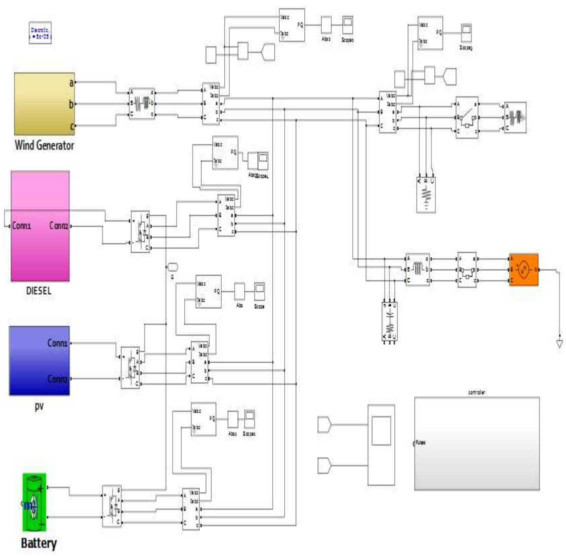


Fig. 9 Overall Simulation Model

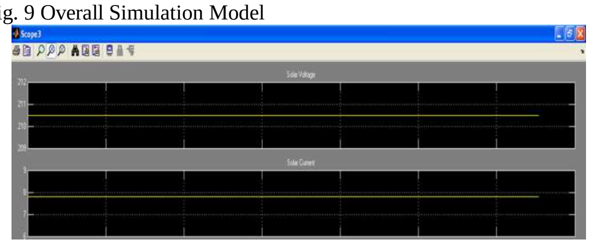


Fig. 10 Input solar panel Voltage and Current

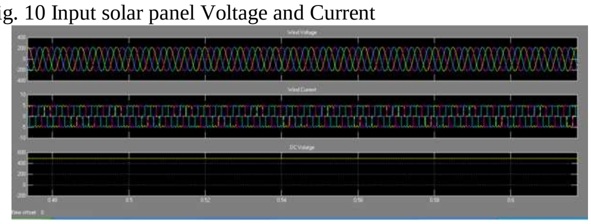


Fig. 11 Input Wind Mill Voltages, Current DC voltage

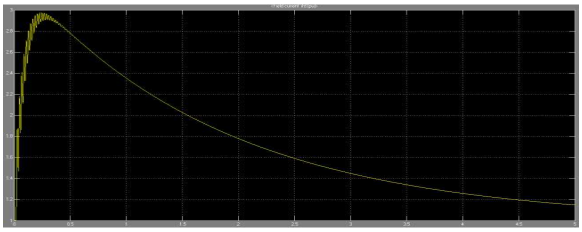


Fig. 12 Input Diesel Generator DC Voltages

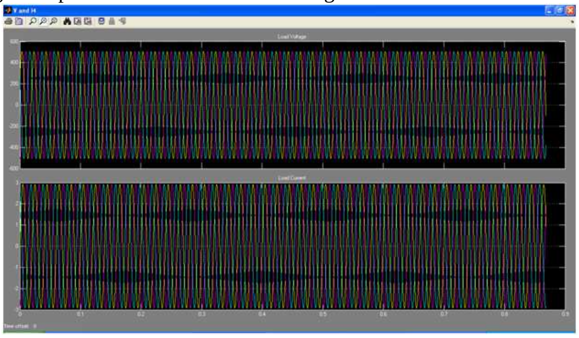


Fig. 13 Load voltage and load current in DG connected operation of microgrid

VI. CONCLUSIONS

This project presents a cost effective power management strategy for secure and stable autonomous operation of micro grids consisting of distributed generations (DGs), energy storage systems and demand response (DR) resources. The proposed strategy consists of two stagesoperating in different timeframes to accommodate the variability and uncertainty introduced by the intermittentintegration of solar and wind turbine system along with the diesel generator as a backup supply. An ANFIS based controller has been designed and the system performance is analysed in terms of power balance and stability considering constant load and variable loads.In order to satisfy the load demand, priority is given to the renewable generation sources and the diesel generator works only to supply the deficit power in order to maintain the power balance. Further, battery storage can also be incorporated in the system. The battery is charged by the excess power when the generation exceeds the load demand,cost effective system operation.

REFERENCES

[1] S. Sivasubramani and K. S. Swarup, “Environmental/economic dispatchusing multi-objective harmony search algorithm,” Elec. PowerSyst. Res., vol. 81, pp. 1778–1785, 2011.

[2]S. Chowdhury, S. P. Chowdhury, and P. Crossley, “Microgrids andactive distribution networks,” IET Renewable Energy Series, 2009.

[3] C. Hou, X. Hu, and D. Hui, “Hierarchical control techniques applied inmicro-grid,” in Proc. IEEE Conf. Power Syst. Technol. (POWERCON),Hangzhou, China, Oct. 2010.

[4] “Assessing the contribution of microgrids to the reliability ofdistribution networks”Paulo Moisés Costa,Electric Power Systems Research 79 (2009)

[5] Davis W. Murray, “Mini Gas Turbines and High Speed Generators – a Preferred Choice for Serving Large Commercial Customers and Microgrids” Part II –Microgrids,2002.

[6]Jen-HaoTeng, Tain-SyhLuor, Yi-Hwa Liu, “Strategic distributed generator placements for service reliability improvements”, in: IEEE PES Summer Meeting,2002.

[7]H. Bindner et al., “Lifetimemodeling of lead-acid batteries” Denmark,Risø Nat. Lab., 2005.

[8]M. Abdel-Akher, A. A. Ali, A. M. Eid, and H. El-Kishky, “Optimal size and location of distributed generation unit for voltage stability enhancement”in Proc. IEEE ECCE, 2011, pp. 104–108.

[9]S.-R. Qi, D.-F.Wang, P. Han, and Y. -H. Li, “Grey prediction based RBF neural network self-tuning pid control for turning process,” inProc. Int. Conf. Machine Learning and Cybernetics, Shanghai, China,2004, pp. 802–805.

[10] S. Premrudeepreechacham, and N. Patanapirom, “Solar-Array Modelling and Maximum Power Point Tracking Using Neural Networks”,IEEE Bologna Power Tech Conference,2003.