Power System Stability for the Islanding Operation of Micro Grids

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Abstract

Objectives: A different power sources has been used and integrated in past keeping an objective for futuristic control over demand and integration to provide smart Grid. **Methods/Statistical Analysis:** New Hybrid model is proposed to enhance performance of micro grid. The method involves a controller with load with simple design procedure with numerical terminology. Considering PV panels, various functions express the irradiation at specified operational temperature like VMP; IMP where in order to reach MPPT value, traditional P&O methods require a few perturbation steps. **Finding:** In addition, Implementation is also done using Pulse Width modulation in converters while switching for utilizing total voltage in a loop. This technique also improves the voltage regulation with less value of THD. The design will be made on SIMULINK of MATLAB and algorithm codes will be written in editor of MATLAB. The result of hybrid model was found to be quite better than the incremental conductance technique in terms of output voltage magnitude and THD content. **Application/Improvements:** This paper aims at developing a novel technique based on Meta-heuristic approach for improved performance of MPPT method for solar cells connected to a grid.

Keywords: Incremental Conductance, Meta-Heuristic, MPPT, P&O, THD

1. Introduction

The consumption of energy is increasing, idea of exploring renewable energy sources are also growing day by day. Due to our limited energy sources, renewable energy sources are the future. There is lot of research done in a field of Stand Alone and hybrid system consisting of Renewable Energy sources like tidal, wind and PV systems in conjunction with conventional systems. With all these resources, the sun power energy can be used nowadays as most reliable, and environmental friendly energy source. Although solar energy have some limitations; in terms of capital cost and optimization; To control these problems, maximum power can be extracted from PV panel while using the MPPT methods to optimize an efficiency of all the PV system. The PV-Hydro Diesel technology can be made attractive option because the features various

merits like as low maintenance requirement, environmental friendliness and absence of fuel cost. PV systems are seldom used due to its less efficiency as it exhibits dc components and involves lot of converters in a process. Due to major use of power electronic devices, current and voltage waveforms are not linear and declined curve is observed while drawing a relation between voltage and power. The output of solar panels depend upon shading nature, number of cells, kind of weather and type of insulation between panels configurations. Due to invariability in input and solar radiations, various techniques and algorithms like MPPT and PSO are designed to extract maximum power and improving real time response in generation.

Global warming or energy policies may become well-popular idea on international agenda at intervals last years. The developed countries area unit tried to chop the rear of

gas emissions. To instance, EU determined for reduction in production of gas to low of 2 hundredth below 1990 levels and provide with no however 2 hundredth of consumption of energy from the renewable sources by 2020[1]. While this, electrical phenomenon power generation significantly to play undeniable fact that it's inexperienced provide. The big emissions area unit associated with the PV power generation unit whose assembly of components. Once the installation generates electricity from star irradiation whereas not emit greenhouse gases. In fundamental quantity, it's around twenty 5 years; PV panels prove heap of the energy for his or her manufacturing[2]. In addition place in places with no alternative different use, like deserts and roofs, or prove to the electricity for remote locations, where the electricity done not any network. The latter kind of installations has understood off-grid facilities and customarily the foremost economical completely different to get electricity within the isolated areas. Hence, PV power generation takes place from the grid-connected installations, where facility could feed at intervals electricity network. Actually, it's the expansion of business within the developed countries like Federal Republic of Germany that in 2010 is out and away the world leader within the PV current generation which will be followed by state, USA, Japan and Italia[3]. On opposite hand, the instrumentation is required, power generation PV are often costlier than different resources. Governments unit are often promote with subsidies or feed-in tariffs, expecting the event of the technology therefore at intervals near future become competitive[4]. The output and approach to get maximum efficiency is the need of hour so that revenues can be increased, and reduces consequently value of facility created therefore approach the worth of facility made of conventional or renewable inputs. The efficiency of PV plant are often affected in main by three factors: efficiency of PV panel between 8-15%[5], the efficiency of converter and therefore efficiency of most electric outlet following algorithmic rule[6]. Rising the efficiency of PV panel and thus the converter is not easy as a result of it depends on the technology available, it ought to want higher components that may increase drastically value of installation. Instead, rising the subsequent of most electric outlet with the new management algorithms has simpler, not dear and may well be worn out plants that unit already in use modification the management algorithms, which could lead to an immediate increase within the PV power generation and consequently discount in its value.

2. Related Work

The work comprising of Hybrid wind solar energy system using maximum power point tracking is presented. The objective in this work is to improve the ability of grid interface hybrid generation system. The performance of MPPT based hybrid system is implemented by using Mat lab/Simulink. The design and analysis of wind energy conversion system by using MPPT are proposed. The proposed algorithm uses direct current which acts as perturbing variable. By using dc link voltage slope, the algorithm is so designed so that it is able to detect minute difference in the speed of a wind. In this work, algorithm is implemented in PSIM 9.1.4 software[6-9]. The maximum power point tracking is obtained of order of 98.32% and 80% for solar and wind respectively. In this paper a novel off-grid hybrid power system comprised of conventional and non conventional systems PV, wind, and hydro energy sources has been presented. A novel approach for connecting renewable energy sources to a utility mini-grid. The proposed modeling of grid connected dc linked pave/hydro hybrid system. The simulation is done in Matlab/Simulink. This proposed approach is cheaper and having less complexity in comparison with AC linked hybrid system. The performance of proposed system is very efficient.

Modeling and Simulation of Utility Interfaced PV/Hydro hybrid Electric Power System is done in Matlab/Simulink. In this work, HEPS and HTG have been simulated. The proposed approaches use real imaginary theory. The proposed analysis of pave hydro isolated power systems. The analysis in this paper is done by using mat lab /Simulink. The simulation results it is found that PV Hydro-Battery energy storage system performs efficiently under different dynamic conditions, maintaining voltage & frequency within the limits. In voltage-based MPPT current-based MPPT approaches unit of the measurement is presented[10]. Every unit of measurement can be simple and fast. Hence, these ways can track the low efficiencies for low irradiation levels. In this paper, a strategy has been projected supported to the analysis and derivation of the I–V characteristics of photo voltaic panel by natural exponent index[11]. This method offers the faster track speed than quality of hill-climbing methodology the used index is solely to complicate for amount calculation exploitation in an inexpensive 8- or 16-bit lC. MPPT management rules unit of the measurement can be supported the prediction line which associates the maxi-

mum power point and optimum current. The parameters are thou selected got to be non-inheritable through hill-climbing methodology that generates commercially impractical. RCC Extended previous analog RCC method to the digital domain for MPP track is presented and the projected digital implementation could be plenty of versatile, smaller quantity expensive; ton of durable quite such as analog RCC methodology, inductive and physical phenomenon parasitic elements may have impact on the facility of RCC to drive system toward being MPP[11].

3. Problem Formulation

The problem of this thesis is to implement a novel PV-Hydro Diesel hybrid system to act as standalone system. The transient stability analysis of the system needs to be done in terms of harmonics in current and voltage. The interconnection of PV-Hydro Diesel system is not an easy task as the output of PV is DC while that of hydro is AC. Thus the PV system needs to be converted to an AC by use of inverter. The MPPT algorithm needs to be developed for performance improvement of the system. An approach used provides flexibility to study the individual sections of system analyzing performance indices. As base and peak power generation plants are in conjunction, therefore for remote areas having fewer loads comparatively, inclusion of battery is preferred in an event of extra power generation. Besides, stand alone systems including PV systems unable to provide regular supply for constant hours, a hybrid system is proposed and need to be studied. While connecting multiple resources particularly non conventional sources, the controlling algorithm is required. The problem of drawing maximum power from solar panel which is to be solved using MPPT technique and improvement algorithm needs to be formulated so better performance. A model for the above stated problem needs to be designed.

4. Proposed Methodology

It is proposed to use a New Hybrid model for improvement of the performance of micro grid. A model will be simulated in which the algorithm will be implemented and the controller will be included with the load. In this work, while designing a controller, a special care has been taken to choose numerical procedure in order to reduce complexity. For desirable EML, numerical procedure has an edge over quantitative analysis. The center is chosen as

(VMP, IMP) considering MPP for specified levels of temperature and irradiation while considering analysis on PV panels. Whenever there is a change in input corresponds to output, then primary techniques like perturb and Observe need to quantify some agitations to obtain maximum value from tracking using orientation. The other step is to carry on regulation loop terminology along with EML. While performed, parallel operation or multi tasking of other objectives, the proposed methodology offers less value of time for tracking. Pulse Width Modulation technique is being used for switching electronic converters involving silicon control rectifiers for improving regulation. This thesis aims at developing a novel technique based on Meta-heuristic approach for improved performance of MPPT method for solar cells connected to a grid. The design will be made on SIMULINK of MATLAB and algorithm codes will be written in editor of MATLAB.
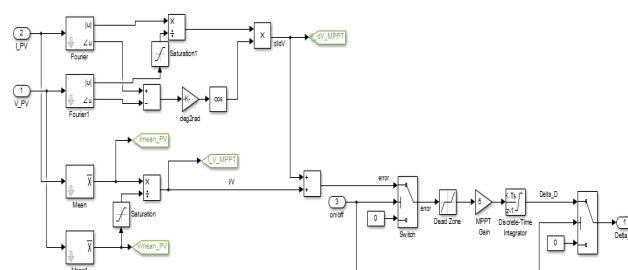

Figure 1. Represents the complete system is connected to an inverter to convert the dc source to ac.
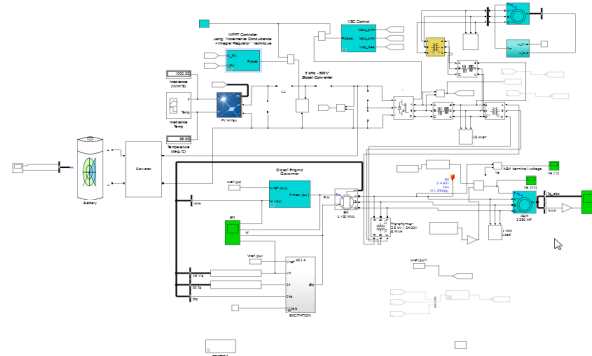

Figure 2. Representing the overall proposed model.

Figure 1 represents the complete system is connected to an inverter to convert the dc source to ac. The ac source can be directly connected to the grid.

Figure 2 represents New Hybrid model for improvement of the performance of micro grid. This pertain to two different micro grids involving solar PV array and

diesel generator connected together with battery to analyze the THD and power quality issues along with stability of micro grid.

5. Results

This section presents the various results which are obtained using the proposed methodology as given in the previous sections. The problem at hand was to develop an MPPT model using IWD for multi-junction solar cell connected to a grid. All the simulations have been done in MATLAB R =2013b in a computer having 2.7 GHz processor and 4 GB RAM.
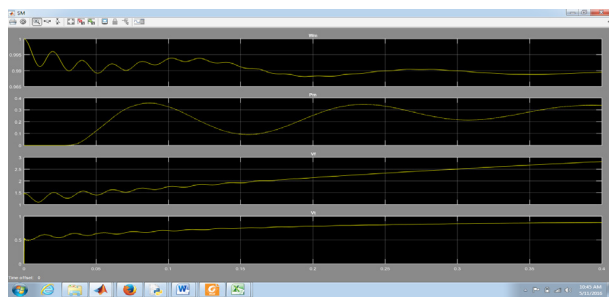

Figure 3. Representing the voltage waveform.

Figure 3 representing the voltage output is found to be quite close to sine wave
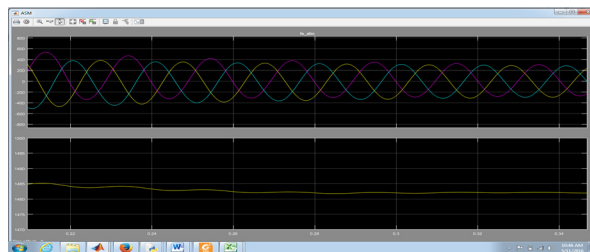

Figure 4. FFT analysis of the voltage waveform.

Figure 4 Representing the FFT analysis of the voltage waveform at the load end. When the FFT analysis of the wave form is done the THD value is found to be 0.17 %.

In Figure 5, the voltage obtained using I & C is also analyzed using FFT and it is found that the THD content of I & C approach is 0.35% which is more than IWD based approach.

Table 1. Showing Comparison of THD

	Load Voltage	Stator Current
THD	2.64%	1.39%

In Table 1, the value of load voltage suggest a small incremental change where as value of stator current is same after proposed methodology.

6. Conclusion and Future Scope

This paper proposed a novel approach of utilizing a New Hybrid Technique approach to solve the MPPT problem in Microgrid consisting of PV-Hydro Diesel cell connected to a grid using three phase inverter. The multi-junction PV-Hydro Diesel cell was assumed to provide better output in terms of voltage. The model for adaptive New Hybrid Technique inference system was designed was designed and developed. The New Hybrid Technique model is used to train itself and track the voltage output based on the THD values of the output. The THD of the voltage was fed as input to the New Hybrid Technique model and as it is trained the firing angle of the boost converter connected to it is computed. The solar cell model was designed and given to boost converter. The converter output was analyzed. An incremental conductance technique was also implemented for comparison purpose.

The result of hybrid model was found to be quite better than the incremental conductance technique in terms of output voltage magnitude and THD content. The THD content reduces using our proposed approach. Also when the current is compared, the oscillations die out very fast in case of hybrid model while in I&C approach it is more or less sustained.
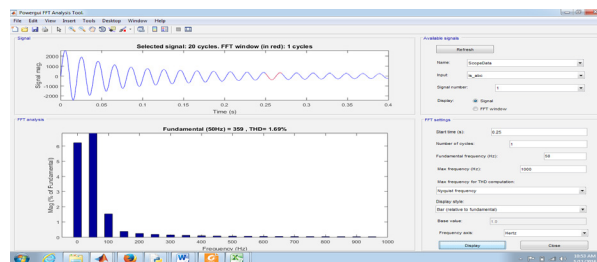

Figure 5. The THD of the output.

In future this algorithm can be improved using other techniques and approaches. Also real time implementation of the algorithms can be done and hardware testing can be done. Hybrid with other algorithms can be utilized and the performances can be compared. Also clustering and other gradient learning methods can be utilized and the model can be tested for grid connection.

7. References

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