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Coordination of Microgrid With Master DC bus

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Abstract:

In this paper, a community micro grid with multiple ac and dc micro grids is imported and evaluated. Individual micro grids with different frequency and voltage requirements would operate as self-contained entities, which could also cooperate with neighboring micro grids for providing backup operations in the community micro grid. A hierarchical coordination strategy (hgs) accompanying primary, secondary, and tertiary coordination is planned for the economic operation of an islanded community micro grid.

The hierarchical strategy is also applied to a grid-connected community microgrid and the results are discussed. The simulation results verify that the recommended hierarchical coordination strategy is an effective and efficient way for coordinating microgrid flows in an islanded community microgrid, while maintaining the rated frequency and voltage with each microgrid.

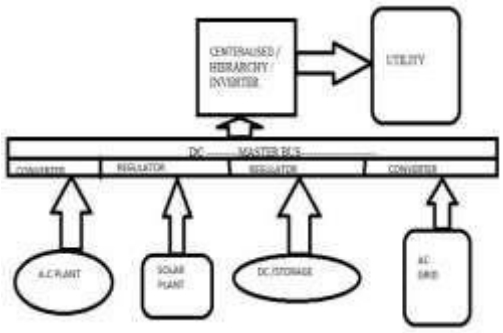
Keywords : hgs- hierarchical coordination strategy.

I.INTRODUCTION

A multi microgrid or community microgrid is formed when a array of neighboring microgrids is linked by means of interlinking-converters. In a community microgrid, individual microgrids may possess their own specific frequency and voltage obligation and perform as self-controlled and autonomous entities. Individual microgrids might also collaborate with neighboring microgrids for providing back-up operations in crisis and for economic purposes. Community microgrid would merge the benefits of ac and dc microgrids and additionally improve the soundness and budgetary performance of individual microgrid systems. Individual microgrids would have their respective connections to the main grid while also co-dependent with other microgrids in the community.

The following features has the drawbacks for the existing.Voltage, frequency and power quality must be considered and composed to adequate standards. Requiring more space and maintenance due to battery banks. Resynchronization with the utility grid is difficult.

Proposed : In our planned community microgrid, each microgrid can operate in each of two grid-connected or island mode, and seamlessly transfer between the two modes. The proposed operation principle of a community microgrid in each mode is encapsulated. The proposed coordination strategy also applies to the grid-connected operation of community microgrid. In the proposed strategy, the primary and secondary coordination are decentralized functions executed by the interlinking-converter of individual microgrids.



The primary coordination initiates the power exchanges based on locally monitoring the density and utilities deviations while the secondary coordination maintaining the frequencies and voltages at graded values for each microgrid. The tertiary allocation, which is a consolidated management function at the community level, ensures the optimal and economic operation of the community microgrid by adjusting the power exchange flows.

MICROGRID: A Microgrid is a provincial vitality grid with control compability, which means it can cut off from the conventional grid and operate individually.

The grid hook up homes, business and other buildings to central power sources, which allow us to use appliances, heating/cooling systems and electronics. Microgrid generally operates while akin to the grid, but importantly it can lay off and operate on its own using local energy generation in times of crisis like storms or power outages, or for other logic.

A microgrid can be powered by distributed generators, batteries and /or renewable resources like solar panels. microgrids connect to the grid at a point of common pairing that maintains voltage at the same level as the main grid unless there is some sort of problem on the grid or other reason to disconnect .A switch can operate the microgrid from the main grid automatically or manually, and it then functions as an island. A microgrid allows community to be more energy self reliant and in some cases, more environmentally affable.

Advantages of Microgrid:

Microgrids can afford electric service to province and communities that are currently unserved. The use of both electricity and heat permitted by the proximity of the generator to the user can increase the overall energy efficiency. Can provide massive accumulation and cut emissions. Microgrid can facilitate the use of inexhaustible energy sources . Power generation units are small and are located in close proximity to load. Can provide high quality and reliable energy supply t o critical loads. Large land practice brunts are avoided. Large transmission build out may be reduced and transmission losses can be reduced.

Components of Micro grid:

Distribution Generation: Distribution generation attributes to power generation at the mark of consumption.generating power on site rather then centrally eliminates the cost,complexity ,interdependencies and inability associated with transmission and distribution.

Energy Storage devices: D.C microgrids will not exist without an energy storage element (e.g fossil fuel, flywheels, batteries, capacitor banks, pumped hydro,as well as other forms).An d.c microgrid's required authenticity and buoyancys will help drive energy storage cost.

Battery : A vail consisting of one or more cells in which chemical energy is converted into electricity and used a source of power .

Point of common coupling: The mark of common coupling is a point in the electrical system where multiple customers or multiple electrical loads may be connected.

Controls: The D.C microgrid presents major challenges from the point of view of its reliable operation and control from the main control principles to microgrid energy management systems. D.C microgrid control scenario can be classified into three levels: primary, secondary and tertiary.

II.HIERARCHICAL LEVELS OF CONTROL

DC microgrid adopts a hierarchical control strategy in grid connected or island modes. The hierarchical control can be categorized as primary, secondary and tertiary.

Primary Control coordination initiates the power exchanges on monitoring the frequencies and voltage deviations.
Seco ndary control coordination maintaining the frequencies and voltage at rated values.
Tertiary control coordination which is centralized management function.

System Benefits of Solar PV Power Plant

The RSC perception provides significant benefits to system planning of utility-scale solar PV power plants. The current state-of-the-art technology is to integrate the energy storage into the ac side of the solar PV system. The RSC notion allows not only the system owners to possess an expandable asset that helps them to plan and operate the power plant accordingly but also manufacturers to offer a cost-competitive dispersed PV energy storage solution with the RSC. The technical and monetary benefits that the RSC solution is able to provide more apparent in larger solar PV power plants.

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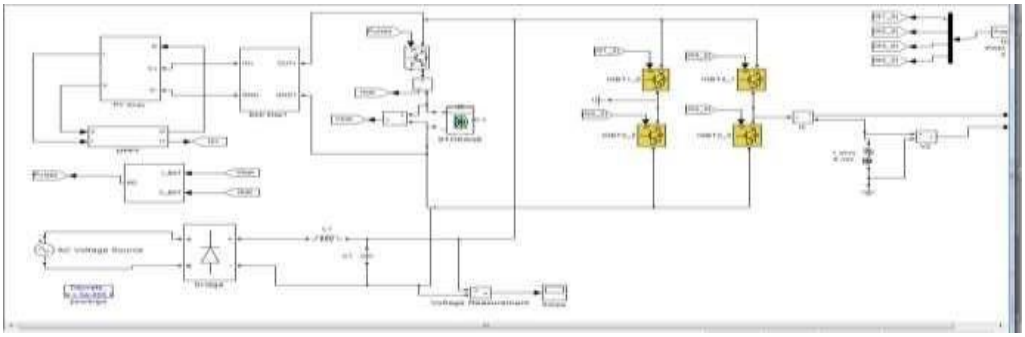
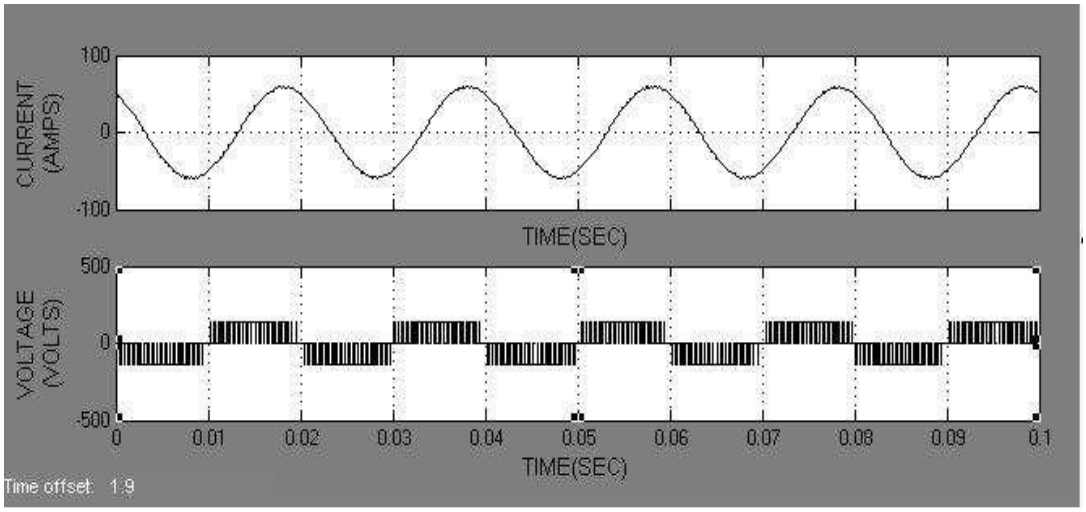
III. SIMULATION RESULTS



Above figure show the simulation circuit

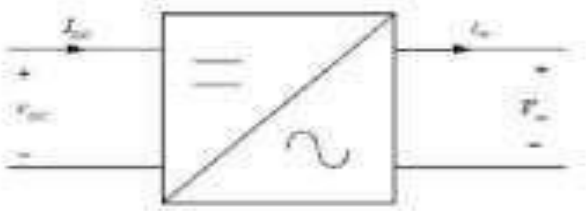


Above figure show the current and voltage output waveform

TYPICAL APPLICATIONS:

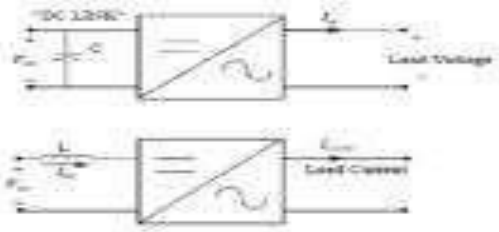
– Un-interruptible power supply (UPS), Industrial (induction motor) drives, Traction, HVDC

General block diagram



Types of inverter

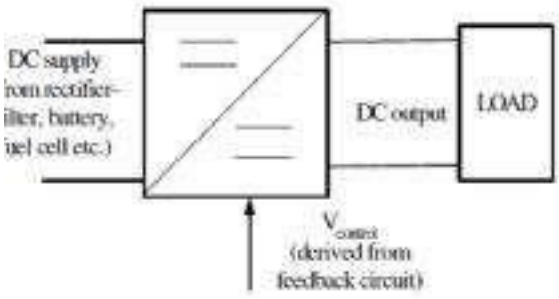
- **Voltage Source Inverter (VSI)**
- **Current Source Inverter (CSI)**



DC-DC Converter

DEFINITION:

Converting the unregulated DC input to a controlled DC output with a desired voltage level.
General block diagram:



APPLICATIONS:

– Switched-mode power supply (SMPS), DC motor control, battery charger. isolated DC-DC requires isolation transformer

- Two types: Linear and Switched-mode
- Advantages of switched mode over linear power supply
  - Efficient (70-95%) -Weight and size reduction
- Disadvantages
  -Complex design -EMI problems

- However above certain ratings, SMPS is the only feasible choice

- Types of SMPS
  -Flyback -forward
  -Push-pull
  -Bridge (half and full)

Maximum power point tracking

(MPPT) is a routine that grid connected inverters, solar battery chargers and similar devices use to get the maximum possible power from one or more photovoltaic devices, typically solar panels, though optical power transmission systems can benefit from comparable technology. Solar cells have a complex relationship between solar irradiation, temperature and total resistance that produces a non-linear output efficiency which can be analyzed based on the I-V curve.

It is the purpose of the MPPT system to sample the output of the cells and apply the proper resistance (load) to obtain maximum power for any given environmental conditions. MPPT devices are typically unified into an electric power converter system that provides voltage or current conversion, filtering, and regulation for driving various loads, including power grids, batteries, or motors.

Constant voltage . The term "constant voltage" in MPP tracking is used to depict different techniques by different authors, one in which the output voltage is regulated to a constant value under all conditions and one in which the output voltage is regulated based on a constant ratio to the measured open circuit voltage (VOC).

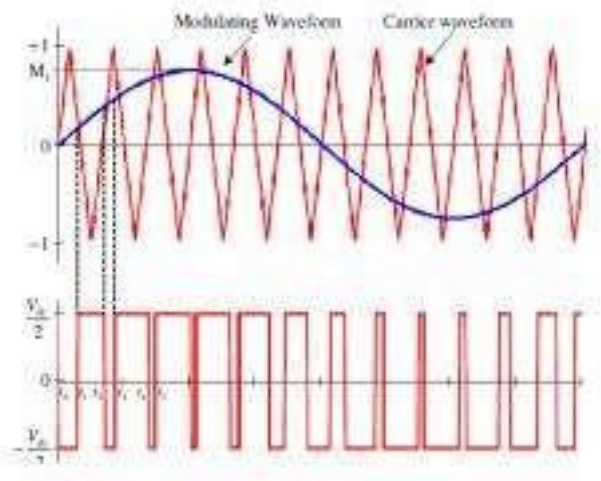
The latter technique is referred to in contrast as the "open voltage" method by some authors. If the output voltage is held constant, there is no attempt to track the maximum power point, so it is not a maximum power point tracking technique in a strict sense, though it does have some advantages in cases when the MPP tracking tends to fail, and thus it is sometimes used to supplement an MPPT method in those cases.

The operating point of the PV array is thus kept near the MPP by regulating the array voltage and matching it to the fixed reference voltage *Vref=kVOC*.

The value of Vref may be also chosen to give optimal performance relative to other factors as well as the MPP, but the central idea in this technique is that Vref is determined as a ratio to VOC.

One of the inherent approximations to the "constant voltage" ratio method is that the ratio of the MPP voltage to VOC is only approximately constant, so it leaves room for further possible optimization.

PWM: Pulse-width modulation(PWM), or pulse-duration modulation (PDM), is a modulation technique that conforms the width of the pulse, formally the pulse duration, based on modulator signal information.



Triangulation method (Natural sampling) Amplitudes of the triangular wave (carrier) and sine wave (modulating) are compared to obtain PWM waveform. Simple analogue comparator can be used. Basically an analogue method. Its digital version, known as REGULAR sampling is widely used in industry.

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PWM types

- Natural (sinusoidal) sampling (as shown on previous slide) – Problems with analogue circuitry, e.g. Drift, sensitivity etc.
- Regular sampling
  – Simplified version of natural sampling that results in simple digital implementation
- Optimized PWM
  – PWM waveform is constructed based on certain performance criteria, e.g. THD.
- Harmonic elimination/minimization PWM
  – PWM waveforms are constructed to eliminate some abominable harmonics from the output waveform spectra. – Highly mathematical in nature
- Space-vector modulation (SVM)

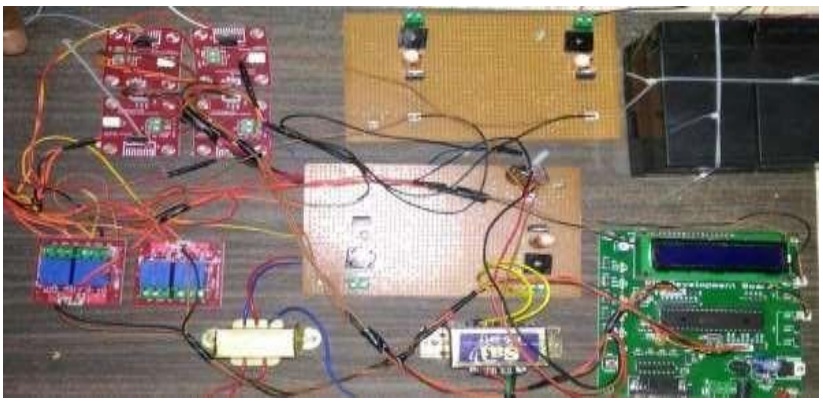
– A simple technique based on volt-second that is normally used with three-phase inverter motor drive. Modulation Index (Modulation Depth) M :

$$M_1 = \frac{\text{Amplitude of the Carrier waveform}}{\text{Amplitude of the modulating waveform}}$$

Modulation Ratio (Frequency Ratio) Mr:-

$$M_r\rho = \frac{\text{Frequency of the modulation waveform}}{\text{Frequency of the carrier waveform}}$$

IV. HARDWARE PHOTO



FEATURES. When One or More microgrids encounters power shortage ,while preserving the rated frequency and voltage for each participating microgrid and economically optimizing the exchanged power, thus ensuring an economic, efficient, and flexible coordination of a community microgrid.

V. CONCLUSION

The simulation outcome also demonstrate the economic operation of a grid-connected community microgrid in which individual microgrids operate as autonomous agents, while satisfying the community objectives. The proposed solution is also capable of providing potential benefits to other intermittent energy sources including wind energy.

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