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Survey of Adaptive Neural Network-Based Control of a Hybrid AC/DC Microgrid

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Abstract: ***In this paper, the grid-connected hybrid AC/DC Microgrid is investigated. Completely different Renewable Energy Sources – photovoltaic modules and turbine generator –have been thought-about at the side of Solid oxide cell and Battery Energy Storage System. The aim of this project is to style and implementation of hybrid AC/DC network and artificial neural network controllers in an efficient manner. Adaptative Neural Networks are wont to track the most power points of renewable energy generators. It control the ability changed between the Front-End convertor and also the electrical grid.***

Keywords: Adaptive interaction, fuel cells, microgrid, neural networks, photovoltaics, predictive control, wind energy, battery energy storage system

1. Introduction

Smartgrids are being developed because the next generation power systems. These smart grids cover interconnected microgrids, particularly at the distribution level wherever distributed generations (DGs) are progressively used. The dg technology will be categorize into power generation from renewable energy (RE) assets similar to wind, electrical occurrence, small hydro, biomass, geothermal, ocean wave and tides, the clean alternative energy (AE) generation technologies like fuel cells and microturbines, additionally because the traditional rotational machine based mostly technologies like diesel generators. as a result of many edges of those sources like cleanness and easy technologies, combined with increasing demands for current and also the exhaustible nature of fossil fuels, the RE and AE-based DGs participate a vital role in microgrids.

MICROGRID (MG) may possibly be a part classification to produce and storages electrical energy that consists of RES (renewable energy sources), local sufficient and energy storage supported batteries or supercapacitors. It's inherent a part of modern and well-liked smartgrids [1], [2], which has additionally intelligent buildings, electrical car stations etc. All RES are using power electronics devices (e.g. converters), that variety considerably increasing and prices decreasing in vary 125th - 5-hitter once a year [3] - [7]. RES are in general associated to the grid and lots of setting up cause the equivalent procedure of RES near one another. This can be one amongst reasons to future change of the classical structure of electrical power systems, toward new resolution containing distributed generation, energy storage, and protection and control technologies, improving their performances.

A typical hybrid ac/dc micro-grid configuration is shown in Fig. 1, during which PV panel and wind turbine is used because the main power generation systems.

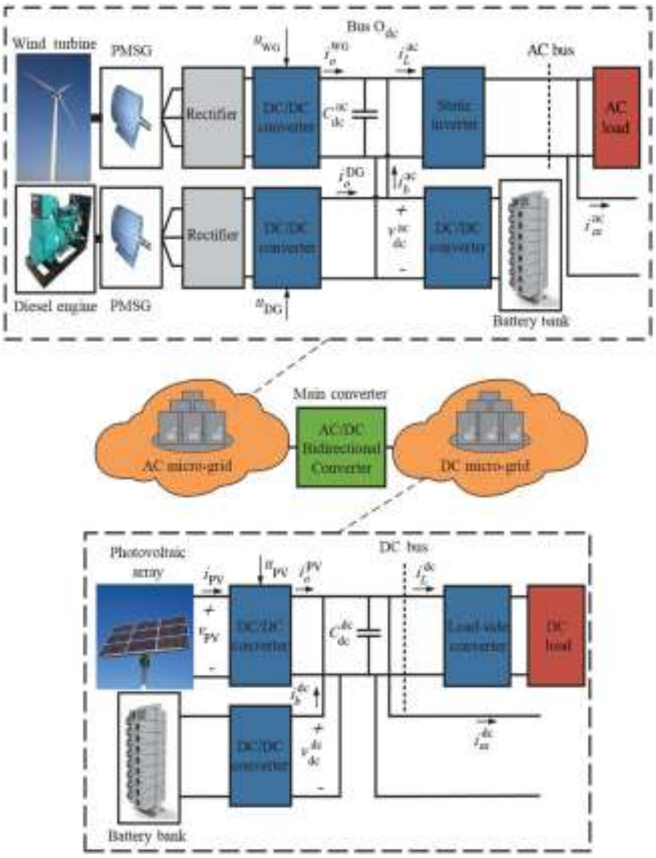

Figure 1: Typical hybrid ac/dc micro-grid configuration

2. Literature Review

In this paper "Adaptive Neural Network-Based Control of a Hybrid AC/DC Microgrid", this work is on the look and validation of a web trained neural network primarily based system for a grid connected hybrid AC/DC microgrid. variety of AI primarily based controllers are developed to follow the utmost electric outlet of the renewable energy sources out there within the microgrid, to manage the facility flow between the front-end device and therefore the electrical grid, and to minimize the purchased energy optimizing the use of the battery energy storage system. The performance of the planned system has been tested for various situations: variable climate conditions, variable hundreds demand, and perturbed grid conditions. The obtained results show the likelihood to manage advanced non-linear systems while not the supply of precise models. Moreover, the planned techniques are flexible, adaptable, need low process prices, and are simple to implement in time period applications. [1]

In this paper "Overview of Power Management Strategies of Hybrid AC/DC Microgrid", In this paper, the topology and control schemes of hybrid AC/DC microgrids are reviewed. Varied structures of hybrid AC/DC microgrids (AC-coupled, DC-coupled, and AC-DC-coupled) are mentioned, and real world samples of differing kinds of hybrid microgrid are bestowed. Within the operation of hybrid AC/DC microgrids, the control schemes and power management ways are one amongst the most vital concerns. Therefore, an intensive review and discussion totally different of various control schemes and power management ways of various forms of microgrids under different operation and loading conditions are conducted during this paper. Implementation samples of some representative control schemes are bestowed to raise illustrate the ability management ways. At last, discussion and suggestions concerning the future analysis directions on AC/DC hybrid microgrids and power management ways are provided. [2]

In this paper "Reactive Power Management in Islanded Microgrid – Proportional Power Sharing in Hierarchical Droop Control", Microgrid is that the advance system for RES integration with own control structure. Sometimes the hierarchical control is enforced with Droop control in primary level. In islanded mode of operation there's the requirement to manage reactive power sharing and permit RESs work with most active power. Hence, the new reactive power sharing algorithmic rule was planned during this paper, supported the analysis of power sharing between converters in microgrid. The novel resolution prevents the reactive power circulation and disconnection or damage of any device in microgrid. Moreover, it permits to converters operation with MPPT, causing higher exploitation of every RES and keeping apparent power of every unit below nominal level as long as attainable. as a result of short change amount of power physical science converters in RES, the algorithmic rule was developed for implementation in gradable control structure, providing parallel calculations in every PCU. Simulation analysis was performed, wherever the 3 answers of power control in islanded microgrid were compared what confirms the right operation of developed algorithmic rule and shows the advantage of proportional power sharing over others solution bestowed in literature. [3]

In this paper "Novel Coordinated Voltage Control for Hybrid Micro-Grid with Islanding Capability", In this paper, the German grid code in short is introduced showing demands from DER units and MG at PCC with their dynamic support requirement and protection settings. The simulated cases W/O CVC and with CVC within the introduced check system are compared against one another in compliance with the German grid codes. The CVC scheme is introduced for a hybrid MG with various varieties of power generations, additionally to slow reactive power control devices while not communication infrastructure. The CVC related to RPMS demonstrates superior performance to manage MG voltage by controlling the reactive power among DERs, OLTC, and Cap Banks for grid connected and islanded mode of operation. Also, the results showed satisfactory performance against the German grid codes, because the case with CVC complies at intervals the voltage and frequency limits. The planned CVC control achieves an equivalent capability of the centralized controller by enhancing the voltage profile, increasing fast dynamic reactive power reserve and transient response. Moreover, it improves the MCCT in response to a fault triggered islanding up to 230 ms and 360 ms throughout internal fault below islanded mode of operation. [4]

In this paper "Cooperative Control of Distributed Energy Storage Systems in a Microgrid", This paper investigates the coordination drawback inside an autonomous microgrid under high penetration of renewable generation. The projected control scheme achieves the subsequent four main deserves.

1) First is that the utilization of BESSs to enhance the renewable energy utility efficiency.
2) Second is that the introduction of a MAS-based distributed approach that reduces the value of the supporting communication network compared to a centralized solution.
3) Third is that the introduction of a consensus algorithmic rule that determines the best marginal cost of charging rates for BESSs.
4) Fourth is that the distributed coordination of varied varieties of DGs (WT, PV, and SG) and BESSs, which may maintain the supply–demand balance inside the microgrid.
5) The model outcome reveals the usefulness of the projected cooperative control strategy. [5]

3. Neural Network Control Systems

Neural networks are applied with success in the identification and management of dynamic systems. The universal approximation capabilities of the multilayer perceptron build it a well-liked selection for modeling nonlinear systems and for implementing general nonlinear controllers. This introduces 3 popular neural network architectures for prediction and management that have been implemented in the Neural Network.

There are typically two steps involved when using neural networks for control:

1. System identification
2. Control design

In the system identification stage, develop a neural network form of the plant that want to control. In the control design stage, use the neural network plant model to design (or train) the controller. The command of design stage, however, is dissimilar for each structural design:

- For model analytical control, the plant representation is use to forecast upcoming behavior of the plant, and an optimization algorithm is used to select the control input that optimizes future performance.
- For NARMA-L2 direct, the organizer is basically a delay of the plant model.
- For model suggestion be in command of, the organizer is a neural network that is trained to control a plant so that it follows a reference model. The neural network plant model is used to assist in the controller training.

4. Hybrid AC/DC Micro-Grid

Fig. 2 shows a typical hybrid system configuration which consists of AC grid on the left side and DC grid on the right side. The AC and DC grids have their corresponding sources, loads and energy storage elements, and are interconnected by a three phase converter. The AC bus is connected to the utility grid through a transformer and circuit breaker.

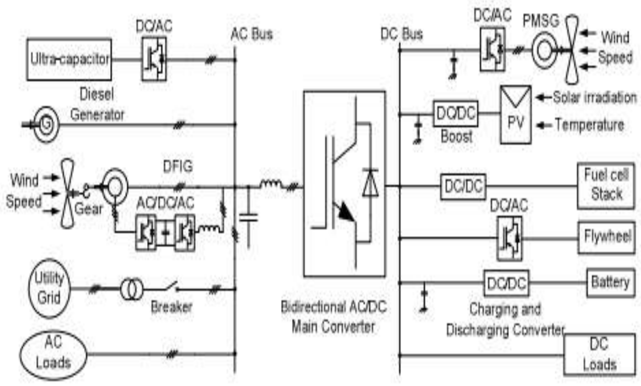

Figure 2: A hybrid AC/DC micro-grid

5. Control Methods for Microgrid System

5.1 Hierarchical Control

Functionally, a microgrid can operate by using the following three main hierarchical management levels:

- Primary management is that the droop management accustomed share load between converters.
- Secondary management is liable for removing any steady-state error introduced by the droop management
- Tertiary management regarding additional global responsibilities decides on the import or export of energy for the microgrid.

5.2 Consensus Control

Consensus among a gaggle of agents or subsystems means that to reach a particular agreement regarding a specific value or quantity that's hooked in to the states of every agent. Consensus control of microgrid coordinated performance is achieved at the secondary level despite the units being out of synchronization at the beginning.

5.3 Decentralized Control

The control of the inverter plus filter interfaces is crucial to the operation of the microgrid. Because of the distributed nature of the system, these interfaces need to be controlled on the basis of local measurements only. The decentralized management of the individual interfaces should address the subsequent issues:

1) Interfaces should share the entire load during a desired approach.
2) Decentralized management supported local measure should guarantee stability on a global scale.

5.4 Networked Control

Another management paradigm supported a SoS which will be extended to a microgrid is networked management. An impact system consisting of a period of time network in its feedback will be termed a networked system. A networked management structure of a microgrid supported a SoS the soundness of the communication network connecting the distributed generation units could be a major concern. Making certain network stability in this situation is of predominant importance. Any packet lost or delays within the communication will cause severe power mismatches among the distributed units. On the other hand, the inverters connected to these systems operate under imbalance conditions because of sensitive loads. This direct to control harmonics and voltage and frequency dissimilarity in the microgrid system and disturbs the stability of the system.

6. Conclusion

In this paper survey of hybrid AC/DC microgrid system. In this paper neural network control system are studied. In this also hybrid AC/DC microgrid system are reviewed. During this paper different control method for microgrid system are discuss. This work is on the look and validation of an internet trained neural network based mostly system for a grid connected hybrid AC/DC microgrid.

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