HYBRID MICRO GRIDS FOR POWER FLOW TO STABILIZE DC CONNECTED FLUCTUATIONS ANN BASED UIPC

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ABSTRACT

The short-circuit current of a power system may thus need to be increased, necessitating the replacement of particular protective devices. It is possible to control the flow of power with this controller (IPC). It is now possible to construct hybrid microgrid power controllers in AC/DC microgrids using a custom Unified Interface (UIPC) controller. The UIPC handles all of the functions of both systems simultaneously when used in conjunction with an IPC or UPFC device. In this project, the energy exchange between AC-DC micro grids is controlled by fewer converters than the customary three converters in each phase of a UIPC setup. The new system incorporates "line power converters" (LPCs) and "bus power converters" (BPCs), which control the intermediate circuit voltage (BPC). Controlling the BPC DC side using an Artificial Neural Network (ANN) is used to stabilize DC connection fluctuations (ANN). ANFIS controllers are less exact than ANN controllers, which are more precise. Usingcomputer simulations, the system's accuracy is tested.

Keywords: Artificial neural network (ANN), bus power converter, and UIPC power controller integrated into AC-DC microgrid

INTRODUCTION

A micro grid is a compact distribution system that contains loads and a framework for managing distributed generation (DG) systems like solar panels and wind turbines. Micro grids may be divided into three categories: DC, AC, and hybrid (AC/DC). Both the sources and the loads in DC micro grids are DC. Future intelligent distribution systems have been found to work best with hybrid micro grids [1-3]. The hybrid micro grid may or may not be connected to the main grid [8]. As shown in Figure 1, ILCs (interconnecting power converters) may be used to connect two microgrids. In hybrid microgrids, the parallel connection of power converters poses a considerable technological challenge. It's feasible to combine many micro grids to form a hybrid micro grid. Two alternating current microgrids and one direct current microgrid are a few examples. This application cannot use ILCs since the common bus voltage must be constant across all micro grids. Interconnectivity between ILCs" All the ILCs that are linked in parallel must divide the micro grids' electricity among themselves. Due to the non-linear nature of micro grid faults, the fault current may be distributed unevenly across ILCs. Because of the high voltage, it's possible that segregating converters will result in severe power loss. That's what's supposed to happen. In other words, thismight cause instability in a micro grid. Harmonics in AC micro grids, which are formed by distortions in AC micro grids, are the cause of ILC and voltage drop phase discrepancy. Power sharing efficiency is reduced when ILCs with differing power factors operate in parallel, resulting in oscillations in voltage and power output. [12] uses a tier-based approach to managing parallel connections. An ILCwith bifocal lenses has been considered. Harmonic repair and a stationary reference frame were employed to develop the control platform (SRF). Since it was developed at the SRF, using this approach is a simple process. Parallel connections of ILCs were handled using a method that ensured that the total of all ILC currents was equal. The "redundant" ILC received a worse rating than any of the other ILCs. As a consequence of this strategy, there will be expenses. In addition to failing to minimise harmonic distortion, the design also fails to reduce reactive power fluctuations, making it less efficient than the current technique. Most noticeable is the ability to connect groups of AC and DC micro grids with UIPC. In light of the above, it's clear that the approach outlined below works: In order to regulate the phase and common AC bus size, a management mechanism is required for the transmission of electricity between an AC micro grid and a bigger, upstream grid, which is controlled by several distributed production units. The AC micro grid is unable to provide energy to the public grid if even a single distributed output ofthe generator is changed. The UIPC may govern the flow of energy between DC and AC subnets instead of controlling power between DC and AC subnets. the movement of currents and the many kinds of When connecting the hybrid micro grid with traditional power converters in series, power factor issues might emerge. The upgraded UIPC, which links the hybrid micro grid, prevents the aforementioned issues. The UIPC (as shown in [24]) might be used instead of a redundant power converter to reduce the fault current. Traditionalcontrol solutions such as instantaneous power control are significantly less dependable and cost- effective than this capability. Re-engineered UIPC has an isolation capability, as illustrated in [24], despite its parallel linked ILCs allowing direct electrical connections between micro grids. Adjustment of both the DC and AC bus voltages of a DC micro grid is possible through the UIPC.Using traditional ILCs in tandem was not an option because of their limitations.

LITERATURE SURVEY

[1] Runfan Zhang, Branislav Hredzak, "Distributed Finite-Time Multi-Agent Control for DC Micro grids with Time Delays", IEEE Transactions onSmart Grid, Early Access, 2018.

An ac microgrid with decentralised battery energy storage uses a distributed multi-agent finite-time control technique with time delays to govern charge balance and voltage restoration. The delays may be as lengthy or as short as feasible depending on the battery system. Double-integrator and single-integrator systems with input delays are transformed using the feedback linearization approach. Time-delayed systems are transformed into delayless ones using the Artstein transformation. For charge balancing and voltage restoration, the simplified models are employed in updating the finite-time control. It is possible to produce control signals using just the state of charge and its derivatives and voltage information sent across a sparse communication network The Lyapunov method provides accurate convergence and finite-time stability in the finite-time domains. The secondary control technique may be used with the primary droop controller. As a result, the proposed control method is resistant to communication failures. Switching converter models and nonlinear lead-acid battery models are used to assess the system's performance in an RTDS Technologies real-time digital simulator.

[2] Distributed model for real-time prediction of optimal operation" in IEEE Transactions on Smart Grid Early Access, 2018.

Several smart microgrids are interconnected in our research, and we've devised a way for efficiently scheduling and trading energy across them. The following goals have been met by this document. Energy storage and reactive power compensation are integral parts of microgrid operation, as are external active/reactive energy trades (with the outside grid and other microgrids) in real-time optimization. Connected microgrids construct scenarios of social cooperation and games in order to maximise their own performance and reap the advantages of energy trading. Furthermore, the broad range of nominal voltages and radial and mesh microgrid integrations are also critical. It is proposed that a model-based and computationally intelligent technology be used to eliminate the requirement for a central controller, allowing microgrid components to function independently with little data interchange. The distributed method suggested in this study may be employed efficiently in real-world microgrid systems, according to numerical simulations for a range of microgrid situations.

[3] Haifeng Qiu, et al, " Bi-level Two-stage Robust Optimal Scheduling for AC/DC Hybrid Multi-micro grids", IEEE Transactions on Smart Grid, Early Access, 2018.

This research provides an efficient scheduling model for the various linked ac and dc microgrids (HMMs). To take into consideration the ac/dc HMM system's uncertainties, a two-stage robust optimum scheduling (also known as adaptive robust) has been implemented, which has been separated into two interest groups: supply and utility. Power limitations and deviation penaltiesare introduced for the interaction lines as part of ac/dc HMM bi-level scheduling and a robust dispatch system. Min-Max-Min problems may be transformed into two-stage mixed integer linear programming problems using the column-and- constraint generation procedure. Case studies have shown the logic and validity of the model and technique for resolution that have been suggested.

[4] Pengfeng Lin, et al, "A Distributed Control Architecture for Global System Economic Operation in Autonomous Hybrid AC/DC Microgrids", IEEE Transactions on Smart Grid, Early Access, 2018.

Because of dispersed generators' increased costs, the overall power system operating costs might be reduced (ICs). According to this research, an AC/DC microgrid with a distributed control architecture (DCA) is presented for global economic operation (MG). The architecture of the building includes two floors. To begin, the functioning of ac and dc subgrids is dependent on the droops of ac frequency and voltage integrated circuits (ICs) (f ac - and VdcIC, respectively). When FAC and VDC synchronisation is established, subgrids will be balanced. FAC and VDC values will be affected by the sagging. It's also possible to recover from f-ac and V-dc byusing a distributed control canonical form (DCCF). Only those in the close vicinity of DGs are allowed to speak with them. It's hard to see what's going on below the grid's surface because of DCCF's impact on f AC and V dc. The hidden loading condition of each subgrid is derived using an original relative loading index (RLI) for each subgrid. The bidirectional interlinking converter may utilise RLI to provide a power reference. In steady state, the DG ICs of the hybrid MG all reach the same value. Loop testing is carried out using simulators andRT-LAB hardware to demonstrate the proposed control architecture is viable and effective.

[5] Daniel E. Olivares, et al, "Trends in Micro gridControl", IEEE Transactions on Smart Grid Volume: 5, Issue: 4, pp. 1905 – 1919, 2014.

It is becoming more common to use microgrids as a method of integrating intermittent renewable energy sources, however this has the potential to bring substantial operational and managerial difficulties. A broad introduction of major control concepts (droop, model-predictive, multiagent systems) and an evaluation of current control tactics and trends in microgrids are included in this study, as well as solutions to these issues. The tertiary level of the microgrid control strategy is more concerned with how well the microgrid interacts with its host grid than the primary and secondary levels are. Using specialised literature, researchers go through every aspect of control.

PROPOSED SYSTEM

An AC/DC hybrid micro grid is seen in Figure 1 and is linked to each other via the Universal Integrated Power Controller (UIPC) (UIPC). Three power converters are required for each level of the typical UIPC construction. Allowing for better control over the flow of power between AC and DC microgrid systems, the number of power converters has been lowered Here we go: the first piece of information that will appear in this document. Each phase features a Line Power Converter, which serves as a power electronic converter (LPC). Another electronic power converter known as a Bus Power Converter is used to regulate the DC bus voltage (BPC).

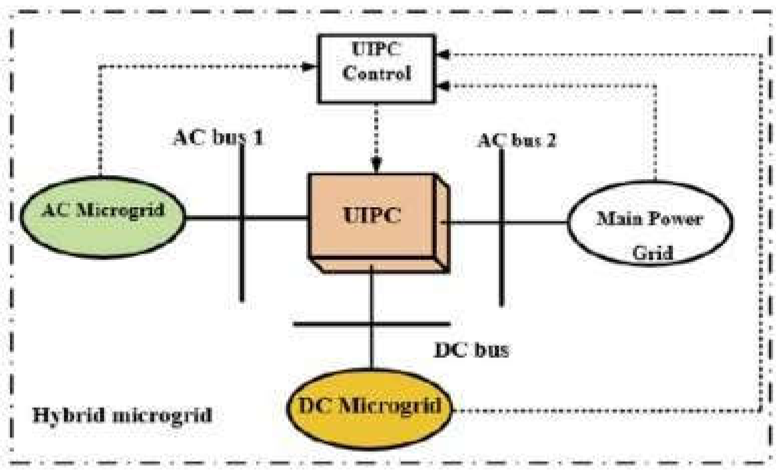

Figure .1 Interconnection of AC-DC micro-grids in hybrid micro-grid connected to grid using UIPC

LPCs are used to connect DC buses to AC microgrids. It is possible to operate in either the inductance- or conductance-mode (CM). An ANNcontroller serves as the foundation for the LPCs' control architecture. For the LPC, the BPC connects to the DC micro-grid. A DC micro-power grid powered by a PV system's oscillating DC voltage is used to make LPC connections. The NDO-MS-SMC (Multiple-Surface Sliding Mode Control) mechanism is used to manage the BPC's DC side [6]. Second edition of the paper is here. This section's UIPC has been dynamically changed, as seen in Figures 6.1 and 6.2. Both a DC and an AC micro-grid are part of the hybrid grid. The UIPC links them all. A diesel generator and the related AC/DC loads are part of the AC micro-grid. Batteries, solar panels, and AC/DC loads make up the DC microgrid. DC buses and DC cables link the batteries to the PV system. Nine VSCs and nine power transformers are needed to connect three ACbus phases.. Since the expense of this construction is significant, All VSCs on the AC bus have their AC and DC lines connected in series. As a result, when the VSC output power fluctuates, or when the system model is disrupted, the common DC link voltage changes as well. Voltage instability in the DC link causes VSCs linked to the same DC connection to have problems operating together. In this case, no consideration was given to it [7].

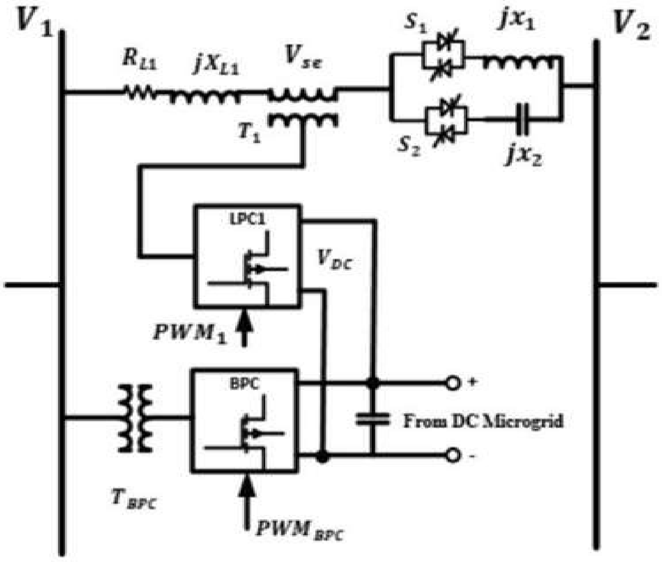

Figure 2 Proposed design of UIPC; each phase implements three power Converters
single one. The AC micro-grid system includes adiesel generator and the AC/DC loads it generates.

PROPOSED ANN CONTROLLER

These devices link to AC microgrids for DC buses. It is possible to operate through inductance or conductance (CM). There is an ANN controller used in the LPC control architecture. Using the DC microgrid as a source of energy, the BPC powers the LPC. DC micro-power grids connect LPCs using an oscillating DC voltage from a PV system. The BPC's DC side is controlled by a Multiple Surface Sliding Mode Regulate [6]. The document's updated version may now be downloaded for free. Figures 6.1 and 6.2 show dynamic changes to the UIPC for this segment. A hybrid grid includes both an AC and DC microgrid. The UIPC connects all of these networks into a Solar panels and batteries make up the DC microgrid, as do AC/DC appliances. A network of DC buses and wires connects the PV system to the batteries. To link three AC bus phases, nine VSCs and nine power transformers are required.. The AC and DC lines of all VSCs on the AC bus are linked in series because of the high cost of this design. As a result, the common DC link voltage varies when the VSC output power changes or when the system model is disturbed. VSCs attached to the same DC connection are unable to function together due to voltage instability in the DC link. No one ever considered it a possibility.

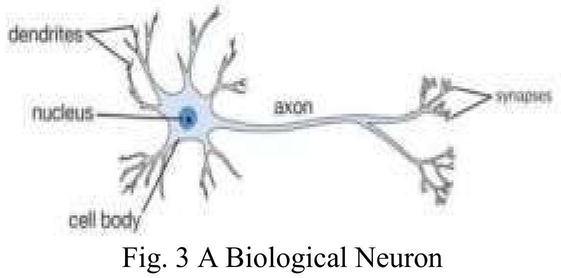

Fig. 3 A Biological Neuron

There are several layers of processing units linked in parallel and fed forward to build up ANNs like this. Neuron-to-neuron connection strength is thought to be the method through which memories are stored in biological brain networks. The word 'weight' is used in neuronal network language to describe the strength or influence of a connection. Different weights of connections between layers of simulated neurons may be generated using this idea. Even though ANNs were first suggested in the early 1960s, they didn't gain much attention until the mid-1980s. Previously, training networks with more than two layers was unfeasible, however this has now changed. Early networks could only describe linear connections between binary input and output characters because of their rudimentary nature. Because of the analogue character of the actual world, a simple binary model is inadequate to describe it. It was the discovery of backpropagation in ANN research that marked the true turning point. Automated neural networks havebecome increasingly popular as personal computers have become more affordable and powerful. Thanks to the neural network, computers can now do tasks that would be impossible for a person to carry out. Simulating the human brain's processes using artificial neural networks is possible (ANNs). We may thus use the human brain as an example to describe the ANN architecture. It is an artificial neural network system that mimics the behaviour of biological networks.

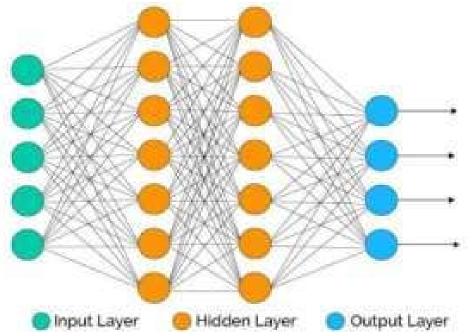

Fig. 4 Model of ANN

An artificial neural network is presented in Figure 4 with a hidden layer, an output layer, and three input layers. It receives and processes information from the environment through a layer of artificial neurons (artificial neurons) (artificial neurons). A system's mastery of a specific task is measured by units at the output layer. Layers between the input and output are known as the "hidden" layers. A transformation made conceivable by a hidden layer may benefit the output unit. There must be a comprehension of how each hidden neuron is linked to all neurons in previous and subsequent layers in order to grasp a neural network (output) (output).

An individual neuron is formed of the elementsdescribed below:

In this manner, it is a neuron (sometimes referred to as a cell or unit), which may be compared to a basic computer. Upon receiving input from other neurons, a neuron conducts a very rudimentary processing of the data, after which it passes the results along to one or more other neurons. In art, neurons are commonly portrayed as squares or circles. In the brain, each layer is a collection of neurons that work together to achieve a given job. Neurons in the same layer are numbered or lettered, and it is commonly known that they are not connected. As demonstrated in Figure 4, synapses and arcuate junctions are capable of both one-way and two-way communication. A feedforward network needs neurons in lower levels to have direct connections to neurons in higher layers to receive input from higher layers. In a recurrent network, communication may be transmitted both ways.The impact of one neuron on another may be assessed by assigning each one a weight (i.e. wij) (i.e. wij). The absence of a weight indicates that there is no impact or correlation that can be created. For as long as one's weight remains positive, one feels comfortable and secure. When a person's weight is negative, they are inhibited.

Persistence rules govern how each cell's outputs aremerged to form a single overall input to the destination neuron in all neurons.

SIMULATION RESULTS

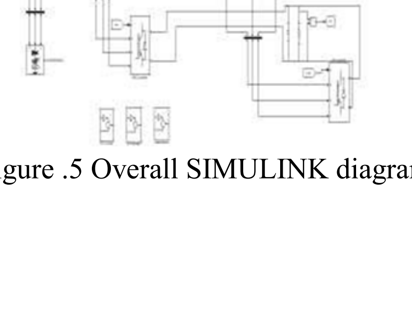

Figure .5 Overall SIMULINK diagram

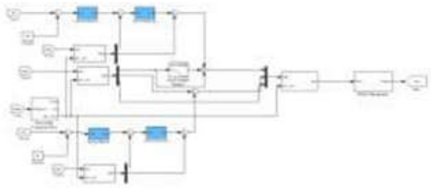

Figure.6 LPC ANN Control System

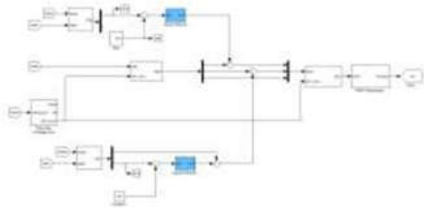

Figure .7 BPC Control System

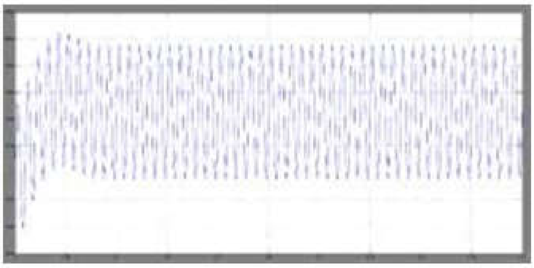

Figure 8 Input Waveform of the DC Micro-grid

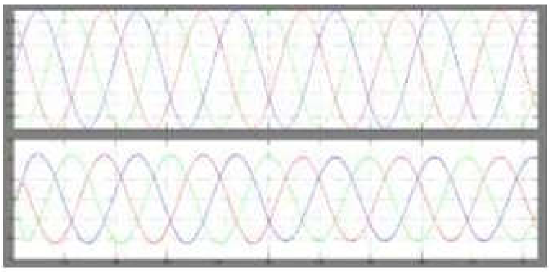

Figure.9 Input Waveform of the AC Micro-grid

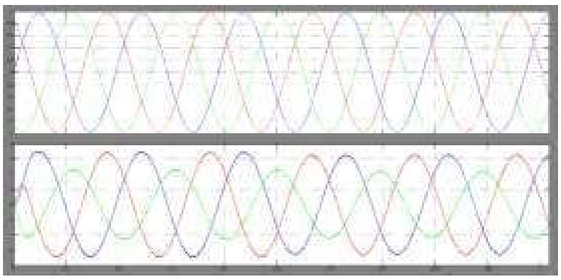

Figure.10 Output Waveform of the Power Grid

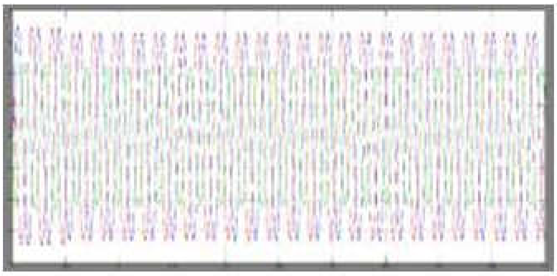

Figure.11 Proposed System Power Grid CurrentWaveform

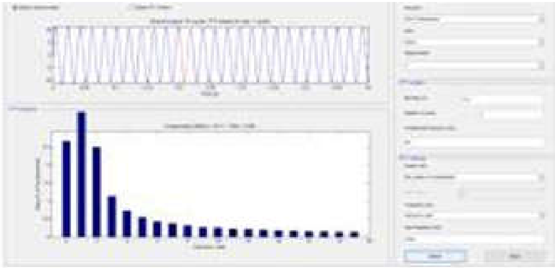

FIG.12 THD% OF SOURCE CURRENT IS 3.10%

CONCLUSION

In the future, hybrid microgrids will most likely be used to meet the demands of both AC/DC and renewable energy sources like wind and solar. Since its design features micro grids that operate onboth AC and DC, it is the most suited option. Parallel-connected power converters have been presented as an alternative to the modified UIPC- based system. We were able to show the validity of its power exchange management with AC micro grids utilising the new model and its modification. The proposed ANN controller has a lower THD percentage than the current ANFIS controller, which has a higher THD percentage.

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