International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

Power Quality Improvement In Integrated Renewable Energy System Using Intelligent Control System

BALAKRISHNAN.M.M , M.TECH (POWER SYSTEM), PRIST UNIVERSITY,THANJAVUR

ABSTRACT

In this paper, a single-phase high-frequency AC (HFAC) microgrid is shown as a novel solution towards integrating renewable energy sources in a distributed generation system. Better utilization of the Micro-grid is achieved by solving power flow and power quality issues using p-q theory-based active filtering called universal active power line conditioner and unified power quality conditioner, respectively.

A distributed intelligent energy management system (DIEMS) is implemented to optimize operating costs. As the optimization greatly depends on the power generation and the power output from renewable sources strongly depends on the weather, the forecast of power generation is required for DIEMS.

A Fuzzy ARTMAP neural network is used to predict hourly day-type outputs based on which generation can be forecasted. Depending on the forecast, an optimization scheme is developed utilizing linear programming along with heuristics.

The results obtained show the successful implementation of HFAC Microgrid with adequate power flow and power quality control, as well as the optimization of operation cost by the DIEMS with Fuzzy ARTMAP-based day-type forecasting. The improvement in the battery life is also achieved due to optimization of storage charge states using the proposed DIEMS.

INTRODUCTION

MICROGRID is a relatively new concept in the electric power distribution. In a Microgrid, a cluster of loads and microsources operate as a single controllable system to provide power and heat in their local area [1]. The capability of adding a number of smaller generation technologies, such as wind, hydro, photovoltaic (PV), fuel cells, gas turbines, batteries, ultra-capacitors, and flywheels, makes the Microgrid a very promising option for on-site power

generation by the end-users. In the modern power scenario where deregulation and state policies encourage end-users to generate their own power in forms of distributed generation (DG), the Microgrid concept is a big step towards solving the controllability problems of distributed resources. Power electronic converters are very important for the Microgrid. The majority of micro sources must be power electronic based to provide required flexibility to insure operation as a single aggregated system.

In the proposed structure, a high-frequency AC (HFAC) link has been used as the power electronic interface to achieve better utilization of the Microgrid. Single-phase 500 Hz high-frequency buses are used to combine the renewable sources with the loads and the grid. The advantages and considerations of HFAC system will be addressed in this paper along with the possible applications of the 500 Hz system. In the HFAC Microgrid, voltage distortions are present due to source and/or converter nonlinearity along with the load current harmonics resulted from nonlinear loads, which cause power quality control an important issue. The proposed system utilizes an active filter called unified power quality conditioner (UPQC) to compensate for these voltages and current harmonics. The control of active and reactive power flow between the micro sources and the grid is also very important for proper utilization of the Microgrid.

A universal active power line conditioner (UPLC) is used to control the power flow from/to Microgrid. Though the UPQC and UPLC have the same basic blocks, known as shunt and series active filters, the controls for both of them as well their functionalities are different. In the UPQC, both the shunt and series active filters are used for harmonics mitigation, so it can be considered as the complete filtering solution. On the other hand, the main function of the series active filter in UPLC is to control the active and reactive power flow.

The change in control algorithm of the series active filter, therefore, enables UPLC to work as a combination of UPQC and active power flow controller. Both UPQC and UPLC consist of series and shunt active filters that use instantaneous power theory (theory) to calculate compensating voltage and currents. The compensating voltage and currents are then synthesized using voltage-source pulse width modulation (PWM) inverters. After the structure of the HFAC Microgrid is defined, the optimization of the operating cost is the next

challenge. A distributed intelligent energy management system (DIEMS) has been implemented for cost optimization.

EXISTING SYSTEM:

This project discusses the use of an AC-AC matrix converter, as an alternative to AC-DC-AC converter system, an interface power converter between a variable load and a wind energy system. A new approach is proposed to solve the commutation problems associated with the switches so it improve the power quality compared to conventional system and it reduces the cost because there is no energy storage element between the line-side and load-side converters. Total harmonic distortion of the power converter is minimized by using filters it improves the power quality. It can be achieve high efficiency without large energy storages. The effectiveness of the proposed method is verified by develop simulation model in MATLAB-Simulink environment.

PROPOSED SYSTEM

The series resonant converters, utilizing zero-voltage or zerocurrent switching, can be used with each of the sources to generate the HFAC link. In this way, the overall losses in the converters can be reduced

CONCLUSION

A single-phase HFAC Micro-grid is shown as an exciting way to integrate renewable energy sources in a DG system. The adequate power flow and power quality control for the Micro-grid is achieved by using single-phase – theory based active filters, thus ensuring better utilization of the renewable sources. The cost of operation for this Micro-grid can be optimized by implementing a DIEMS, consisting of a Fuzzy ARTMAP NN for prediction and an optimization module.

REFERENCES:

[1] H. Fujita and H. Akagi, “The unified power quality conditioner: The integration of series and shunt-active filters,” *IEEE Trans. Power Electron.*, vol. 13, no. 2, pp. 315–322, Mar. 1998.

[2] S. Chakraborty and M. G. Simões, “Advanced active filtering in a single phase high frequency AC Microgrid,” in *Proc. IEEE-Power Electron. Specialist Conf.*,

PESC , Recife, Brazil, Jun. 12–16, 2005, pp. 191–197.

[3] G. A. Carpenter, S. Grossberg, N. Markuzon, and J. H. Reynolds, "Fuzzy ARTMAP: A neural network architecture for incremental supervised learning of analog multidimensional maps," *IEEE Trans. Neural Netw.*, vol. 3, no. 5, pp. 698–713, 1992.

[4] B. Gustavsen, J. A. Martinez, and D. Durbak, "Parameter determination for modeling system transients-Part II: Insulated cables," *IEEE Trans. Power Del.*, vol. 20, no. 3, pp. 2045–2050, Jul. 2005.

[5] N. Amekawa,N. Nagaoka, and A. Ametani, "Impedance derivation and wave propagation characteristics of pipe-enclosed and tunnel-installed cables," *IEEE Trans. Power Del.*, vol. 19, no. 1, pp. 380–386, Jan. 2004.

[6] J. M. Corrêa, S. Chakraborty,M. G. Simões, and F. A. Farret, "A single phase high frequency ACMicrogrid with an unified power quality conditioner," in *Proc. IEEE 38th–IAS Annu. Meeting Conf. Rec.*, Salt Lake City, UT, Oct. 2003, vol. 2, pp. 956–962.

[7] J. Liu, J. Yang, and Z. Wang, "A new approach for single-phase harmonic current detecting and its application in a hybrid active power filter," in *Proc. 25th Annu. Conf. IEEE Ind. Electron. Soc.–IECON*, Nov. – Dec. 29 – 3, 1999, vol. 2, pp. 849–854.