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Sliding Mode Adaptive Control of a Standalone Single Phase Microgrid Powered by a Solar PV Array

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Abstract- *An Upgraded power quality standalone single phase microgrid system with adaptive sliding mode control (ASMC) is presented in this research. The proposed microgrid system combines a wind-driven permanent magnet brushless DC (PMBLDC) generator, a solar photovoltaic (PV) array, and a battery energy storage system with a governor-less micro-hydro turbine-driven single-phase two winding self-excited induction generator (SEIG) (BESS).*

***Key Words*: Solar PV Array, Wind turbine, Battery Energy Storage System, Adaptive Sliding Mode Controller.**

1. INTRODUCTION

The microgrid concept is particularly appealing for successfully addressing the issues of renewable energy integration. Depending on the design of a control scheme, a microgrid is work in both standalone and grid modes. The main grid supplies scarce electricity while a grid-connected microgrid absorbs surplus power to maintain power balance and system frequency. Power balance and system voltage regulation are the most difficult aspects of running a standalone microgrid. An ASMC technique was initially designed to be used in powerful switching gains, with the goal of producing a fast adaptation rate at any moment when the switching gains rise or decrease. Although it provides good tracking performance, the switching advantages may be affected by the parameter configuration for modifying the adaption rate near the sliding manifold Following that, another. The ASMC technique with auxiliary parameters has been used to reduce sensitivity in with respect to the parameter configuration Unfortunately, due to a large number of variables, it is a time-consuming operation. a large number of tweaking parameters It is possible that the control performance will be altered as a result of this.

2.RENEWABLE SOURCES

2.1 Solar Energy -T energy is an infinite source of energy derived from the sun. When the light and heat from the sun are used directly without changing the form, this is referred to as direct or passive solar energy technology, and when it is used by converting the form of energy, this is referred to as indirect or active solar energy technology. The photovoltaic

technology is the well-known indirect method, while the solar thermal system is the direct method of harvesting the abundant energy. There are various methods for generating electricity from renewable energy sources. As a result, there are several options for connecting the generated electricity to the existing grid.

2.2 Wind Energy – This energy is energy draw out from the wind. We extract using a windmill. It is made up of renewable energy sources. Wind energy requires less money to generate electricity. Wind energy systems also have lower maintenance costs. Wind energy is available in every time in a day. It produces fewer pollution. The system's initial cost is also lower.

Except for photovoltaic cells, electricity is generated by both generators. This operation generates co-current flows, which are routed into the power grid via an inverted rectifier.

2.3 BESS- The growing use of decentralised electricity infrastructure models depends on Battery Energy Storage Systems (BESS). Rapid improvements in battery technology have greatly improved utility- and commercial-scale models for producing renewable energy.

The BESS is equipped with cutting-edge technologies that allow it to collect charge from the connected solar array, make the best use of the collected power, and discharge that power during designated "high-energy consumption" times. BESS technology significantly improves stand-alone power systems (SAPS) and microgrids by assuring reliable day-and-night-time delivery of stored energy.

3. SIMULATION RESULT

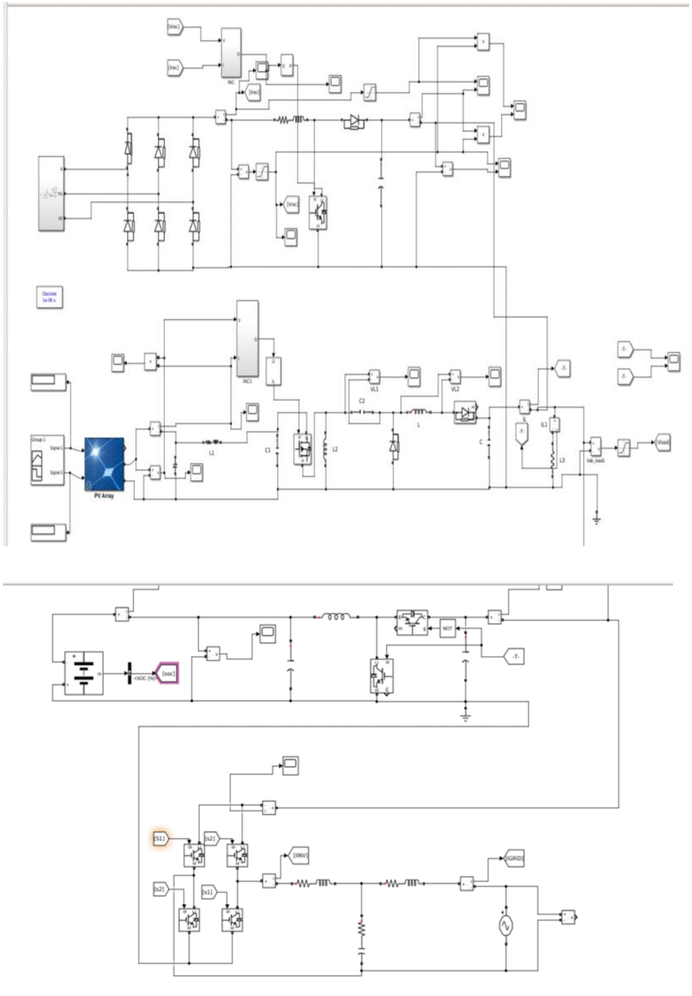
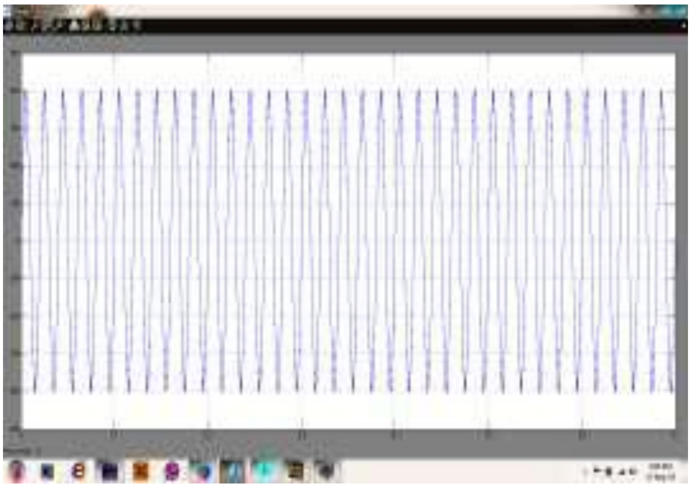


Fig. 1 Simulation of Proposed System

CASE-1: CHANGE IN SOLAR LEVEL



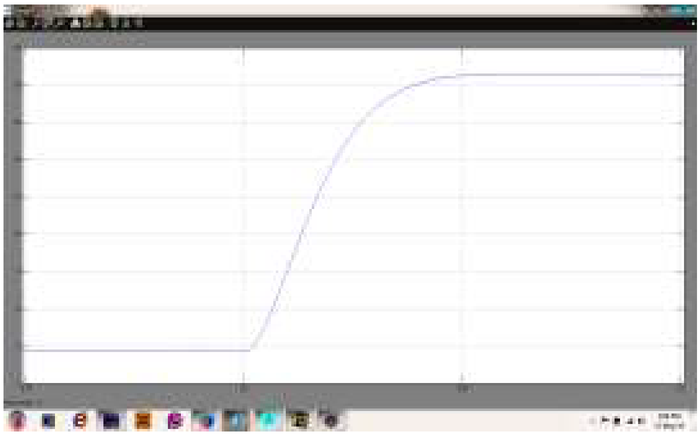
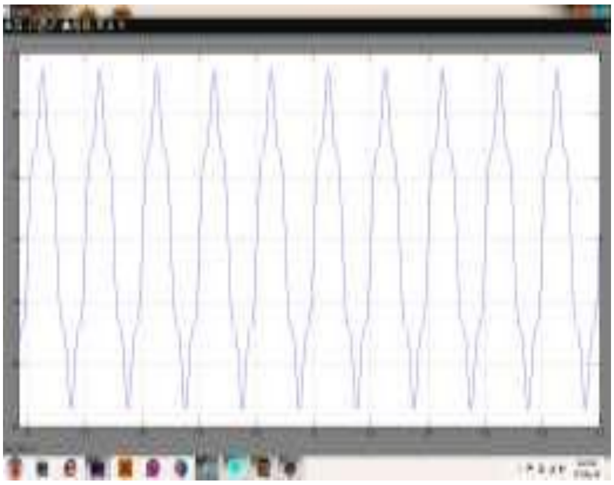


Fig2.Dynamic functioning of the Ipv, and Ibattery as the system responds to a step increase in insolation

CASE-2: WIND SPEED CHANGE



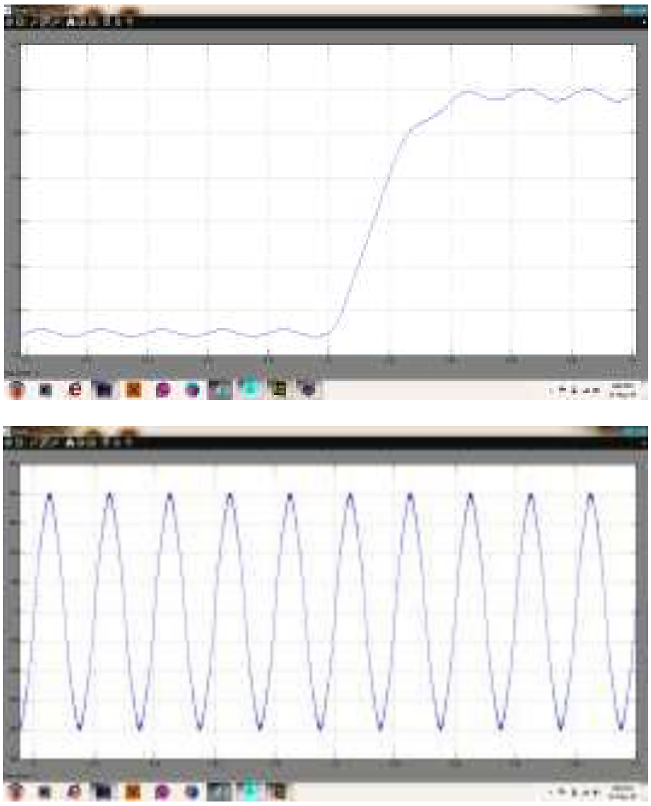
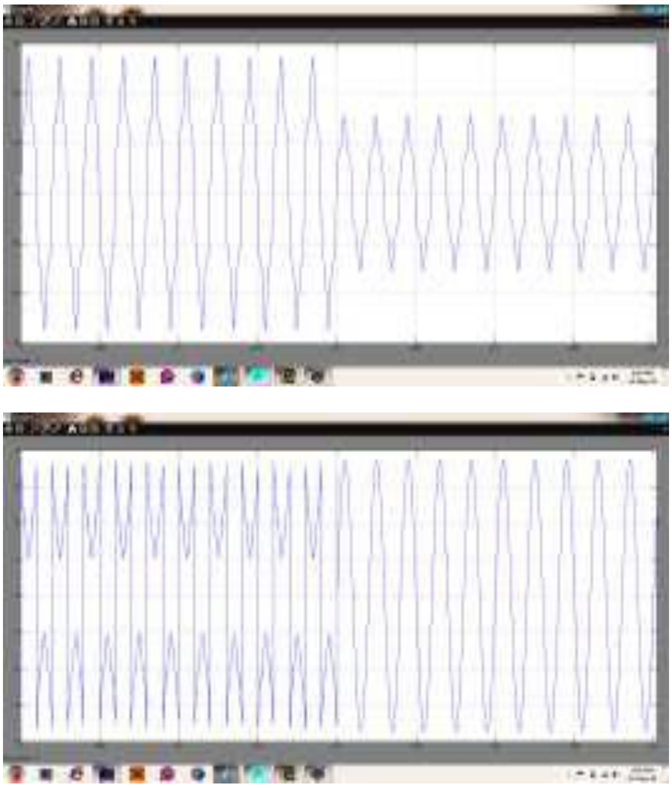


Fig 3. Dynamic response of IL, iVSC, Ipmbldc and Ibattery, while the system is following a step increase in wind speed

CASE-3: CHANGE IN LOAD



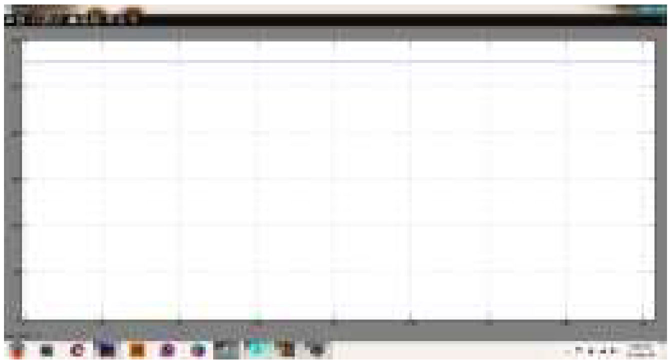


Fig.4 Change in wind speed and load

6. CONCLUSIONS

For voltage and frequency regulation of the independent single-phase microgrid, a real-time adaptive sliding mode control algorithm was implemented with the DSP controller. The ASMC algorithm is efficient, according to test results, and there is good voltage and frequency control in place. The proposed control algorithm also improves microgrid power efficiency under linear and nonlinear charges, as well as ensuring the efficient use of BESS and renewable energy sources.

7.REFERENCES

[1] P. Dondi, D. Bayoumi, C. Haederli, D. Julian, and M. Suter, "Network integration of distributed power generation," J. Power Sources, vol. 106,nos. 1–2, pp. 1–9, 2002.

[2] J. P. Lopes, N. Hatziargyriou, J. Mutale, P. Djapic, and N. Jenkins, "Integrating distributed generation into electric power systems: A review of drivers, challenges and opportunities," Elect. Power Syst. Res., vol. 77, no. 9, pp. 1189–1203, 2007.

[3] N. Hatziargyriou, H. Asano, R. Iravani, and C. Marnay, "Microgrids," IEEE Power Energy Mag., vol. 5, no. 4, pp. 78–94, Jul./Aug. 2007.

[4] N. Ruiz, I. Cobelo, and J. Oyarzabal, "A direct load control model for virtual power plant management," IEEE Trans. Power Syst., vol. 24, no. 2, pp. 959–966, May 2009.

[5] H. Morais, P. Kádár, M. Cardoso, Z. A. Vale, and H. Khodr, "VPP operating in the isolated grid," in Proc. IEEE Power Energy Soc. Gen. Meetting, Pittsburgh, PA, USA, 2008, pp. 1–6.

[6] D. Pudjianto, C. Ramsay, and G. Strbac, "Virtual power plant and system integration of distributed energy resources," IET Renew. Power Gener., vol. 1, no. 1, pp. 10–16, Mar. 2007.

[7] A. Molderink, V. Bakker, M. G. C. Bosman, J. L. Hurink, and G. J. M. Smit, "Management and control of domestic smart grid technology," IEEE Trans. Smart Grid, vol. 1, no. 2, pp. 109–119, Sep. 2010.

[8] D. Pudjianto, C. Ramsay, and G. Starbac, "Microgrids and virtual power plants: Concepts to support the integration of distributed energy resources," Proc. Inst. Mech. Eng. A J. Power Energy, vol. 222, no. 7, pp. 731–741, 2008.

[9] H. Karimi, H. Nikkhajoei, and M. R. Iravani, "Control of an electronically-coupled distributed resource unit subsequent to an islanding event," IEEE Trans. Power Del., vol. 23, no. 1, pp. 493–501, Jan. 2008.