ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Mitigation Voltage Fluctuation and Flickering by using PMSG

Jani Khan Patan
Department of Electronics and Electrical Engineering,
Sai Ganapathi Engineering College,
Visakhapatnam, Andhra Pradesh 531173, India.

ABSTRACT:
Voltages fluctuations and flicker are linked terms and are commonly used indistinctly. Nonetheless, these terms are defined differently, although they frequently can occur at the same time. Therefore, it is essential to clearly differentiate these two terms: Voltage fluctuations are defined entirely from an electrical point of view and are described as variations of the voltage waveform whose amplitudes are bound to of the nominal voltage level. The magnitude of these voltage fluctuations are typically well below the thresholds of sensitivity of most electrical equipment and are not likely to result in operating problems. However, for some specific cases, voltage fluctuations can induce variations in the luminous flux of light sources, hence, affecting the light bulbs operation.

Terms: Voltages, fluctuations, flicker

Introduction:

The International Electro technical Commission (IEC) standard IEC 61000-3-7, defines flicker as an impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time. Essentially, flicker corresponds to the visual discomfort experienced by a person, when exposed to variations in the luminous flux of light sources [6]. These luminous flux variations are induced by voltage fluctuations, thus, there is a clear connection between flicker and voltage fluctuations [1]. However, a human factor is involved in the definition of flicker, while voltage fluctuations are defined entirely from an electrical point of view. This implies that in order for a flicker problem to occur, the following two factors are required:

1) Voltage fluctuations causing variations in luminous flux, defined as the objective factor and
2) A person exposed to these luminous flux variations, defined as the subjective factor.

Thus, as the human physiological process has a significant influence in quantifying the flicker disturbance, thorough knowledge of the human visual perception is essential for the measurement of the flicker.

Factors influencing flicker:

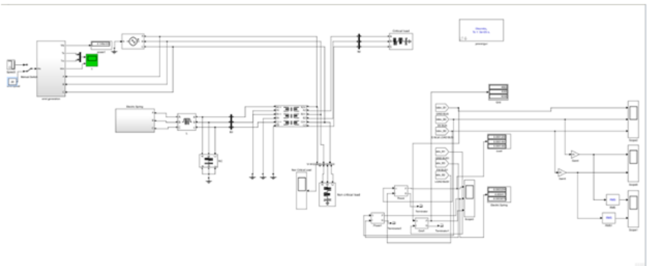
The connection of a large wind farm to a distribution network may greatly influence the flicker level in the supply voltage provided to utility customers. The main factor contributing to the deterioration of voltage quality are the rapid variations of the wind farm’s output power, which induce fluctuations in the feeder’s voltage, attributing to flicker [7]. Flicker emissions arise in consequence of the fluctuating nature of the wind farm’s output power which is composed of both deterministic components (due to tower shadow and wind shear) and stochastic components (due to wind gusts, wind turbulence and wind speed variability. Furthermore, network characteristics such as the short circuit capacity, grid impedance angle and the local load will be the determining factors attenuating or aggravating the feeder’s flicker level [2].

Cite this article as: Burla Tirumala Venkatesh Babu & Desireddy Dwija, "Improvement of Voltage Stability Using Dynamic Voltage Restorer Using Fuzzy Logic Controller", International Journal & Magazine of Engineering, Technology, Management and Research, Volume 5, Issue 6, 2018, Page 138-141.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

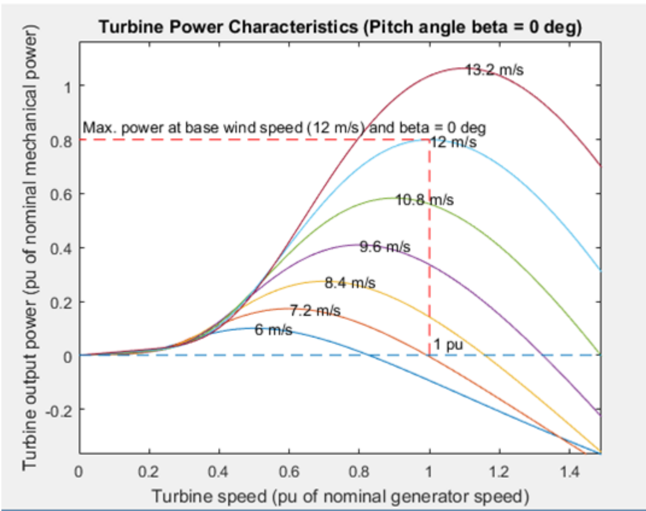
LOAD DEMAND MANAGEMENT IN MICRO-GRIDS DISTRIBUTION:

Power generation by wind speed results into fluctuations in voltage and frequency and due to this fluctuating nature of wind power generation. It affects the performance of micro-grid. It thusgive challenge to the safety of micro-grid in terms of its stability [8]. To cope up with the above problem, there should be proper balancing between load and generation. Some methods such as load shedding or use of energy storage have been use in the earlier days. But this method does not give instant load demand management in real time [3].



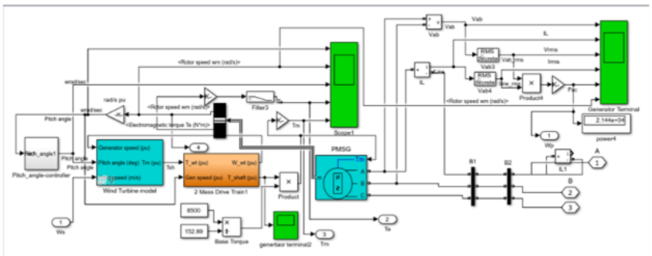
Distribution of wind energy for critical and non critical loads

WIND TURBINE CHARACTERISTICS



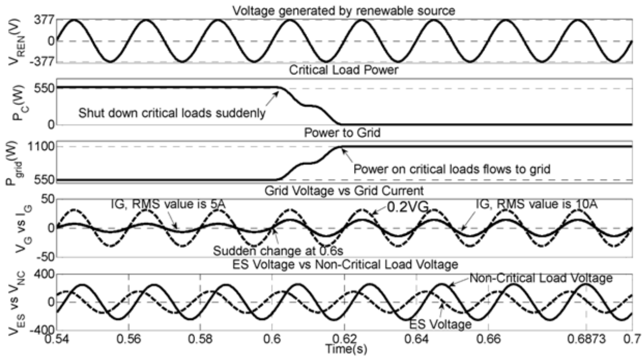
Turbine characteristics

WIND ENERGY GENERATION



Wind energy generation with PMSG

Electric spring characteristics with load



(d)

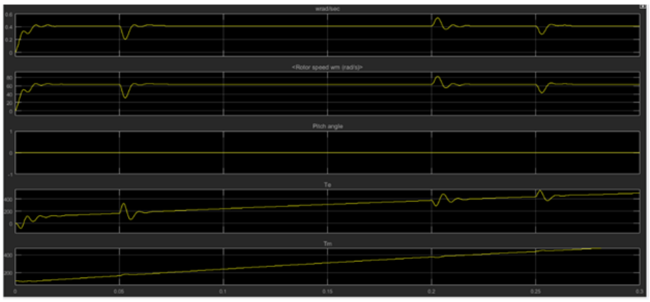
Electric spring characteristics with load

The critical load is connected in parallel to the smart load consisting electric spring and noncritical load. The voltage across it is Vs. Also, electric spring can be utilized for both active and reactive power compensation [4,9]. The compensation voltage Vahave to be perpendicular to the noncritical load current Io in order to make electric spring lossless.

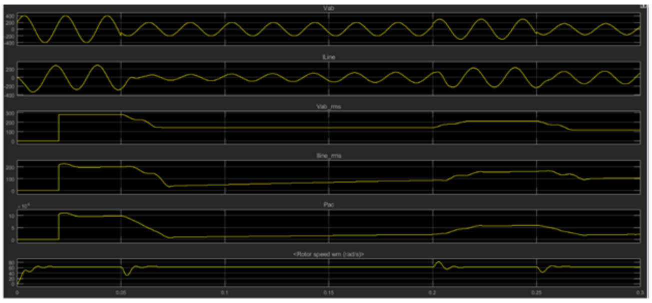
This means for a resistive-inductive load Va should be leading Io by 90° and provides capacitive compensation and vice-versa for resistive capacitive load. The phasor sum of noncritical load voltage Vo and ES voltage Va is equal to the voltage at PCC [5,10].

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

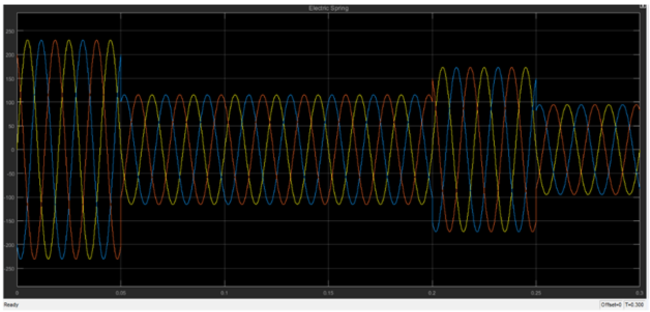
SIMULINK OUTPUTS



Output of wind turbine



Outputs of PMSG



Electric spring output

CONCLUSION:

The electric spring based smart loads have been used for load demand response managementunder MW size PMSG in VSWECS under distribution system. Modeling and control for a full bridge voltage source converter based ES have been presented for grid bus voltage regulation. To emulate realistic wind power generation and its injection in to the grid, wind Speed has been modeled considering its stochastic and deterministic components. The study presented under Case-I has demonstrated that fluctuating wind power injection resulted in voltage disturbances and severe voltage flickers propagation at each bus of distribution network. However, the study presented in Case-II clearly shows that with smart loads, voltage disturbances at all buses of distribution feeder decreases and voltage flicker severity indexes are decreased. Therefore, deploying SLs using ES is proven an effective alternative among other solutions in reducing flickers in the test feeders. Moreover, presented sensitivity analysis has strengthened claim of above study that deploying SLs helps in increasing penetration level of renewable energy. The proposed load demand response management using SLs has been effectively employed for voltage control under high wind energy penetrations in the distribution feeder.

REFERENCES:

[1] J. A. Martinez and J. Martin-Arnedo, “Voltage sag studies in distribution networks- part II: Voltage sag assessment,” IEEE Trans. Power Del., vol. 21, no. 3, pp. 1679–1688, Jul. 2006.

[2] J. A. Martinez and J. M. Arnedo, “Voltage sag studies in distribution networks- part I: System modeling,” IEEE Trans. Power Del., vol. 21, no. 3, pp. 338–345, Jul. 2006.

[3] P. Hcine and M. Khronen, “Voltage sag distribution caused by power system faults,” IEEE Trans. Power Syst., vol. 18, no. 4, pp. 1367–1373, Nov. 2003.

[4] S. S. Choi, B. H. Li, and D. M. Vilathgamuwa, “Dynamic voltage restoration with minimum energy injection,” IEEE Trans. Power Syst., vol. 15, no. 1, pp. 51–57, Feb. 2000.

[5] C. Fitzer, M. Barnes, and P. Green, “Voltage sag detection technique for a dynamic voltage restore,” IEEE Trans. Ind. Appl., vol. 2, no. 1, pp. 203–212, Jan./Feb. 2004.

[6] C. Benachaiba and B. Ferdi, "Voltage quality improvement using DVR," Electt.Power Qual. Utilisation, Journal, vol. XIV, no. 1, 2008.

[7] D. M. Vilathgamuwa, H. M. Wijekoon, and S. S. Choi, "A novel technique to compensate voltage sags in multiline distribution system-the interline dynamic voltage restorer," IEEE Trans.Ind. Electron., vol. 53, no. 5, pp. 1603–1611, Oct. 2006.

[8] J. G. Nielsen, M. Newman, H. Nielsen, and F. Blaabjerg, "Control and testing of a dynamic voltage restorer (DVR) at medium voltage level," IEEE Trans. Power Electron., vol. 19, no. 3,pp. 806–813, May 2004.

[9] M. J. Newman, D. G. Holmes, J. G. Nielsen, and F. Blaabjerg, "A dynamic voltage restorer (DVR) with selective harmonic compensation at medium voltage level," IEEE Trans. Ind. Appl.,vol. 41, no. 6, pp. 1744–1753, Nov./Dec. 2005.

[10] A. K. Jindal, A. Ghosh, and A. Joshi, "Critical load bus voltage control using DVR under system frequency variation," Elect. Power Syst. Res., vol. 78, no. 2, pp. 255–263, Feb. 2008.

[11] Y. W. Li, D. M. Vilathgamuwa, P. C. Loh, and F. Blaabjerg, "A dualfunctional medium voltage level DVR to limit downstream fault currents," IEEE Trans. Power Electron., vol. 22,no. 4, pp. 1330–1340, Jul. 2007.

Author Details:

Jani Khan Patan
Department of Electronics and Electrical Engineering, Sai Ganapathi Engineering College, Visakhapatnam, Andhra Pradesh 531173, India.