



Improved Kalman Filter Based Inverter Control for Reduction of Low Order Current Harmonics due to Isolation Transformers in Renewable Energy Sources

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Abstract. This paper is focused on the analysis of a Kalman filter performance when introduced in the current control loop of a distributed generation connection inverter. The idea is to use this kind of filter to reduce the harmonic content of the currents injected in the point of common coupling. The study has been performed by means of simulation using Matlab-Simulink and clearly demonstrates that this kind of control system can improve the response produced by the inverters. The elimination of certain well-known noisy harmonics introduced by an element such as the isolation low voltage transformer has been accomplished.

Key words

Distributed generation, harmonic compensation, Kalman filters, renewable energy efficiency.

References

- [1] MIT E.E. Staff, *Magnetic Circuits and Transformers*, MIT Press 1943.
- [2] K. De Brabandere, B. Bolsens, J. Van den Keybus, A. Woyte, J. Driesen and R. Belmans, "A voltage and frequency droop control method for parallel inverters", in *Proc. PESC 2004*, pp. 2501-2507.
- [3] Li-Cheng Zai, Christopher L. DeMarco, and Thomas A. Lipo, "An Extended Kalman Filter Approach to Rotor Time Constant Measurement in PWM Induction Motor Drives", *IEEE Trans. On Industry Applications*, Vol. 28, No. 1, pp. 96-104, January/ February 1992.
- [4] R. Dhaouadi, N. Mohan and L. Norum, "Design and implementation of an extended Kalman filter for the state estimation of a permanent magnet synchronous motor," *Power Electronics, IEEE Transactions on*, vol. 6, pp. 491-497, 1991.
- [5] Aurobinda Routray, Ashok Kumar Pradhan, and K. Prahallad Rao, "A Novel Kalman Filter for Frequency Estimation of Distorted Signals in Power Systems", *IEEE Trans. On Instrumentation and Measurement*, Vol. 51, No. 3, pp. 469-479, June 2002.
- [6] Kalman, R.E. (1960). "A new approach to linear filtering and prediction problems". *Journal of Basic Engineering* 82 (1): 35-45.
- [7] B. D. O. Anderson, J. B. Moore and M. Eslami, "Optimal Filtering," *Systems, Man and Cybernetics, IEEE Transactions* vol. 12, pp on., 235-236, 1982.
- [8] E. J. Leffens, F. L. Markley and M. D. Shuster. (1982, 1982). "Kalman filtering for spacecraft attitude estimation." *Journal of Guidance, Control, and Dynamics* vol 5, pp. 417-429.
- [9] L. Matthies, T. Kanade and R. Szeliski, "Kalman filter-based algorithms for estimating depth from image sequences," *International Journal of Computer Vision*, vol. 3, pp. 209-238, 09/01. 1989.