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Application of Single Tuned Passive Filters in Distribution Networks at the Point of Common Coupling

Authors : M. Almutairi, S. Hadjiloucas

Abstract : The harmonic distortion of voltage is important in relation to power quality due to the interaction between the large diffusion of non-linear and time-varying single-phase and three-phase loads with power supply systems. However, harmonic distortion levels can be reduced by improving the design of polluting loads or by applying arrangements and adding filters. The application of passive filters is an effective solution that can be used to achieve harmonic mitigation mainly because filters offer high efficiency, simplicity, and are economical. Additionally, possible different frequency response characteristics can work to achieve certain required harmonic filtering targets. With these ideas in mind, the objective of this paper is to determine what size single tuned passive filters work in distribution networks best, in order to economically limit violations caused at a given point of common coupling (PCC). This article suggests that a single tuned passive filter could be employed in typical industrial power systems. Furthermore, constrained optimization can be used to find the optimal sizing of the passive filter in order to reduce both harmonic voltage and harmonic currents in the power system to an acceptable level, and, thus, improve the load power factor. The optimization technique works to minimize voltage total harmonic distortions (VTHD) and current total harmonic distortions (ITHD), where maintaining a given power factor at a specified range is desired. According to the IEEE Standard 519, both indices are viewed as constraints for the optimal passive filter design problem. The performance of this technique will be discussed using numerical examples taken from previous publications.

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