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PWM Harmonic Injection and Frequency-Modulated Triangular Carrier to Improve the Lives of the Transformers

Authors : Mario J. Meco-Gutierrez, Francisco Perez-Hidalgo, Juan R. Heredia-Larrubia, Antonio Ruiz-Gonzalez, Francisco Vargas-Merino

Abstract : More and more applications power inverters connected to transformers, for example, the connection facilities to the power grid renewable generation. It is well known that the quality of signal power inverters it is not a pure sine. The harmonic content produced negative effects, one of which is the heating of electrical machines and therefore, affects the life of the machines. The decrease of life of transformers can be calculated by Arrhenius or Montsinger equation. Analyzing this expression any (long-term) decrease of a transformer temperature for 6º C - 7º C means doubles its life-expectancy. Methodologies: This work presents the technique of pulse width modulation (PWM) with an injection of harmonic and triangular frequency carrier modulated in frequency. This technique is used to improve the quality of the output voltage signal of the power inverters controlled PWM. The proposed technique increases in the fundamental term and a significant reduction in low order harmonics with the same commutations per time that control sine PWM. To achieve this, the modulating wave is compared to a triangular carrier with variable frequency over the period of the modulator. Therefore, it is, advantageous for the modulating signal to have a large amount of sinusoidal “information” in the areas of greater sampling. A triangular signal with a frequency that varies over the modulator’s period is used as a carrier, for obtaining more samples in the area with the greatest slope. A power inverter controlled by PWM proposed technique is connected to a transformer. Results: In order to verify the derived thermal parameters under different operation conditions, another ambient and loading scenario is involved for a further verification, which was sampled from the same power transformer. Temperatures of different parts of the transformer will be exposed for each PWM control technique analyzed. An assessment of the temperature be done with different techniques PWM control and hence the life of the transformer is calculated for each technique. Conclusion: This paper analyzes such as transformer heating produced by this technique and compared with other forms of PWM control. In it can be seen as a reduction the harmonic content produces less heat transformer and therefore, an increase in the life of the transformer.

Keywords : heating, power-inverter, PWM, transformer
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