ABSTRACT

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In this dissertation, a modulation technique employing Selective Harmonic Elimination Pulse Width Modulation (SHE–PWM) with Genetic Algorithm (GA) was developed in order to synthesize waveforms 7 levels in the phase voltages of MLC² (*Multilevel Clamped Multilevel Converter*) proposed. The proposed topology derive from MLC²–5L (*Multilevel Clamped Multilevel Converter – 5 Levels*) modular and uses the classic NPC–3L technology (*Neutral Point Clamping – 3 Levels*) reducing the amount of components (power semiconductor switches, diodes and capacitors) in compared to DCMC–7L (*Diode Clamped Multilevel Converter –7 Levels*) and is called MLC²–7L modular (*Clamped Multilevel Mul-tilevel Converter – 7 Levels*). The SHE–PWM provides operation at low switching frequency while the AG, from the analysis of specific fitness functions, determines the switching angles used in the modulation to suppress individual harmonic components of low order (5th, 7th, 11th and 13th), reduce the total harmonic distortion (THD%), control the amplitude and frequency of the fundamental component of the converter phase voltage and accomplish the specifications provided in Module 8 – Power Quality (PRODIST – ANEEL). These angles are loaded in SIMULINK for further analysis from the results. Initially, simulations were performed without amplitude control. In this case, the AG examined two functions presented in the literature. Then, tests with modulation index (m_a) variable were performed, however, were evaluated 4 functions described in the literature most 1 proposal. In all tests, the number of switching angles ranged from 3 to 9, in order to determine the effect of increasing the variables in signal quality synthesized by the converter in relation to THD%, the selective harmonic elimination, the switching frequency and the operating limit of modular MLC²–7L. Finally, all the results obtained from simulations are compared with the power quality requirements set by ANEEL. Still, it is importante to note that were not used filters in the output of the proposed converter. This modulation technique can be applied to all topologies multilevel converters currently available with any number of levels.

Keywords: Modulation; SHE–PWM; Genetic algorithms; MLC²; NPC; Switching frequency; Multilevel converter; Total harmonic distortion; Selective harmonic suppression; Modulation index; Power quality.