Switching Angles Computations Using PSO in Selective Harmonics Minimization PWM

Salman Ahmad and Atif Iqbal

Abstract The preprogrammed pulse width modulation (PWM) method for operating power converters ensures minimum switching loss and at the same time better quality waveform at the output. The Fourier series analysis of the predefined output waveform with the removal of certain low order harmonics yields a set of trigonometric equations in which switching angles are treated as variables. It results in removal of preselected harmonics from the output and control on the fundamental component. The main challenge in implementation of selective harmonics minimization is in solving of these system of highly non linear equations which have different number of solutions for different range of modulation index. The particle swarm optimization technique can be used to obtain switching angles from the system of highly non linear equations by properly formulating an objective function which need to be minimized. The requirement of symmetry constraints on the output waveform can be implemented using penalty function approach. The main advantage of the PSO approach over algebraic and numerical based techniques is that it can be used for computation of large number of switching angles with less dependency on the initial guess of the solution.

Keywords Selective harmonics mitigation · Multilevel inverter · Pulse width modulation · Particle swarm optimization · Total harmonics distortion

1 Introduction

The computation of wider range of solution from the highly non linear sets of transcendental equations is important in low switching frequency based harmonics minimization pulse width modulation of voltage source inverter [1–3]. In this context the

S. Ahmad (✉)
Islamic University of Science and Technology, Awantipora, J&K, Awantipora 192122, India
e-mail: salman.ahmad@islamicuniversity.edu.in

A. Iqbal
Qatar University, Doha, Qatar
e-mail: atif.iqbal@qu.edu.qa

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2021

H. Malik et al. (eds.), *Metaheuristic and Evolutionary Computation: Algorithms and Applications*, Studies in Computational Intelligence 916,
https://doi.org/10.1007/978-981-15-7571-6_18