Geometric algebra framework applied to Symmetrical Balanced Three-Phase Systems for Sinusoidal and Non-Sinusoidal Voltage Supply

Francisco Montoya[1], Raul Baños[1], Alfredo Alcayde[1], Francisco M. Arrabal-Campos[1], and Javier Roldan-Perez[2]

[1]Universidad de Almeria
[2]IMDEA - Energy

December 21, 2020

Abstract

This paper presents a new framework based on geometric algebra (GA) for solving and analysing three-phase balanced electrical circuits under sinusoidal and non-sinusoidal conditions. The proposed approach is an application of the geometric algebra power theory (GAPoT) to three-phase systems. Calculations are performed in a multi-dimensional Euclidean space where cross effects between voltage and current harmonics are taken into consideration. A definition of geometric apparent power for three-phase systems that complies with the energy conservation theorem is introduced. By using the proposed framework, the current can be easily decomposed into active- and non-active components for current compensation purposes. The paper includes detailed examples in which electrical circuits are solved and the results are analysed. This work is a first step towards a more advanced polyphase proposal with realistic cases, where unbalance and asymmetry is included.

Hosted file

`Gapot3F.pdf` available at https://authorea.com/users/384046/articles/499862-geometric-algebra-framework-applied-to-symmetrical-balanced-three-phase-systems-for-sinusoidal-and-non-sinusoidal-voltage-supply