DIRECTIONAL MAGNETIC AND ELECTRIC VORTEX LINES AND THEIR GEOMETRIES

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May 5, 2020

Abstract

In this study, we firstly introduce a different type of directional Fermi-Walker transportations along with vortex lines of a non-vanishing vector field in three-dimensional space. Thus we conclude that geometric quantities, which are used to characterize vortex lines, are also associated with the geometric phase and angular velocity vector (Darboux vector) of the system. Then we present directional magnetic vortex lines by computing the Lorentz force. Hence, we reach a remarkable relation between directional magnetic vortex lines and angular velocity vector of vortex lines with a non-rotating frame. We later determine the directional electric vortex lines by considering the electromagnetic force equation. We finally investigate the conditions of being uniform for magnetic fields of directional magnetic vortex lines and we improve a remarkable approach to find the electromagnetic curvature, which contains many geometrical features belonging to directional electric vortex line.

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