World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:19, No:05, 2025

Beam Methods Applications to the Design of Curved Pulsed Beams

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Abstract : In this study, we consider two methods for synthesizing a pulsed curved beam along a generic beam-axis trajectory. In the first approach, we evaluate the space-time aperture field distribution that radiates the beam along a predefined trajectory by constructing a time-dependent caustic surface around the beam-axis skeleton. We derive the aperture field delay to form a caustic of rays along the beam axis and extend this method to other points over the aperture. In the second approach, we harness the proven capabilities of beam methods to address the challenge of designing curved intensity profiles in three-dimensional free space. By leveraging advanced beam propagation techniques, we create and manipulate complex intensity patterns along arbitrarily curved trajectories, offering additional possibilities for precision control in various wave-based applications. Numerical examples are presented to demonstrate the robust capabilities of both methods.

Keywords : pulsed Airy beams, pulsed beams, pulsed curved beams, transient fields
Conference Title : ICMPCP 2025 : International Conference on Metamaterials, Photonic Crystals and Plasmonics
Conference Location : Amsterdam, Netherlands
Conference Dates : May 13-14, 2025