3D Modeling of Transformation Optics Based Flattened Luneburg Lens Using the COMSOL Multiphysics® Software

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Abstract

Three-dimensionally varying flattened Luneburg Lens structure whose axisymmetric invariance of material parameters is calculated by conformal mapping, presents a numerical challenge for three dimensional modelling. To address this problem, conventionally a two dimensional quasi-conformal mapping of the two-dimensional structure is carried out to calculate the conformally mapped constitutive parameters of the lens and the functionality of the two dimensional modified luneburg lens is verified by exciting the structure with a two dimensional source (line current) and predicting an equivalent function for the axisymetrically rotated three-dimensional structure which is excited by waveguide experimentally. But, the simulation of the three-dimensional far field radiation pattern and gain calculation of the axisymetrically rotated three dimensional flattened luneburg lens is of particular interest for performance evaluation and is not achievable with two dimensional modelling.
In this paper, we present a three-dimensional modelling and simulation approach of the three dimensional flattened luneburg lens based on quasi-conformal transformation optics to numerically compute the actual far field radiation pattern and predict the gain.