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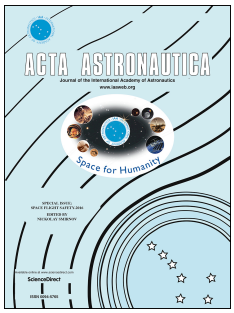

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An Investigation of Millimeter Wave Reflectarrays for Small Satellite Platforms

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Abstract

This article reports two contributions related to reflectarray antenna design at millimeter waves (mm-waves). First, a closed form analytical formulation is provided for the prediction of reflection properties of square/rectangular mm-waves reflectarray unit cells based on various quality factors and the theory of waveguide coupled resonators. To ensure a high accuracy at mm-waves, the effects of fringing fields, surface waves, metal conductivity, and metal surface roughness are included in the analysis. This analysis program greatly facilitates the parametric studies of a unit cell's constituting parameters to converge on an optimum design solution. Secondly, the concept of phase quantization is proposed for a cost effective realization of mm-waves reflectarrays. The developed formulation in the first contribution was used to design two 3 bit phase quantized, single layer, 19 wavelength, passive reflectarrays at 60 GHz. The test results are compared with simulations and a very good agreement was observed. These findings are potentially useful for the realization of high gain antennas for mm-wave inter-satellite links in small satellite platforms.

Keywords: Antenna, Reflectarray, Reflection Loss, Satellite, Unit Cell

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