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Title:Hybrid spectral-domain ray tracing method for fast analysis of millimeter-wave and terahertz-integrated antennas

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Abstract:In this paper, we present a computationally efficient hybrid spectral ray tracing (HSRT) method that requires only one spectral domain integration step for each observation point. The HSRT method is capable of modeling arbitrary three-dimensional dielectric and metallic structures. We compare and validate various versions of the HSRT method including MoM-SRT, and MLFMM-SRT, with measurements and commercial software FEKO for method of moments (MoM), multi-level fast multipole method (MLFMM) and physical optics (PO) via simulation of a bow-tie terahertz antenna backed by hyper-hemispherical silicon lens and an on-chip dipole antenna attached to lens. It is shown that the MoM-SRT is more accurate than MoM-PO and comparable in speed. The HSRT algorithm is applied to simulation of on-chip dipole antenna backed by Silicon lens and integrated with a 180-GHz VCO and compared with measurements. In addition, it is shown that the matrix formulation of SRT and HSRT is a promising approach for solving complex electrically large problems with high accuracy.

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