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论文

介质球的各向异性瑞利散射

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摘要:

基于电磁场的多尺度理论,研究了各向异性介质球内、外电场的规律,导出了各向异性目标散射场的表达式,得到了各向异性介质目标散射振幅、散射截面等的解析表达式,并对其正确性进行了检验.仿真结果表明:各向异性介质球的散射具有偶极辐射的特点,介电常量越大,产生的偶极矩也愈大,散射也越强.其结果可为各向异性目标监测、各向异性光散射研究等提供理论支持.

关键词: 各向异性介质 张量 光电磁散射

Anisotropic Rayleigh Scattering for a Dielectric Sphere

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Abstract:

Based on the scales theory of electromagnetic wave,the law of electric field inside and outside an anisotropic medium sphere is researched.The formula of scattering field from the anisotropic targets is derived.The differential scattering cross section and the scattering amplitude etc.for the anisotropic spherical target are presented.The correctness of the obtained results is tested.Simulation results show that the scattering of an anisotropic sphere has the property of a dipole radiation.The bigger the dielectric constant is,the stronger the dipole and the scattering are.These results provide a theoretical basis for the light scattering from an anisotropic target and the identification of anisotropic targets.

Keywords: Anisotropic medium Tensor Light electromagnetic scattering

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参考文献:

[1]CHENG X,KONG J A,RAN L.Polarization of waves in reciprocal and nonreciprocal uniaxially bianisotropic media[J].PIERS,2008,4(3):331-335.

[2]YAN Bing,HAN Xiang-e,REN Kuan-fang.Light scattering of gaussian beam from an eccentrically stratified dielectric sphere and application[J].Acta Photonica Sinica,2009,38(5):1268-1274.
颜兵,韩香娥,任宽芳.离心球对高斯波束的光散射及应用[J].光子学报,2009,38(5):1268-1274.

[3]CHEN H T,ZHU G Q,HE S Y.Using genetic algorithm to reduce the radar cross section of three-dimensional anisotropic impedance object[J].PIERB,2008,9(1):231-248.

[4]ZHANG Wei,WANG Hong-yuan,WANG Zhi-le.Modeling method for visible scattering properties of space target[J].Acta Photonica Sinica,2008,37(12):2462-2468.
张伟,汪洪源,王治乐.空间目标可见光散射特性建模方法研究[J].光子学报,2008,37(12):2462-2468.

[5]KOKKORAKIS G C.Scalar equations for scattering by rotationally symmetric radially inhomogeneous

anisotropic sphere[J].Progress In Electromagnetics Research Letters,2008,3(2):179-186.
[6]PAN Yong-qiang,WU Zhen-sen,HANG Ling-xia.Influence of Ag thin films on surface roughness and light scattering of optical substrate[J]. Acta Photonica Sinica,2009,38(5)：1197-1203.
潘永强,吴振森,杭凌侠.银薄膜对光学基底表面粗糙度及光散射的影响[J]. 光子学报,2009,38(5)：1197-1203.
[7]COLLIN R E.Field theory of guided waves[M] .New York :McGraw-Hill,1991:75-83.
[8]GRAGLIA R D,VSLENGHI P E.Electromagnetic scattering from anisotropic materials — Part II:Computer code and numerical results in two-dimensions[J].IEEE Trans on Antennas Propagat,1987,35(2):232-252.
[9]REN W.Contributions to the electromagnetic wave theory of bounded homogeneous anisotropic media [J].Phys Rev E,1993,47(1):664-673.
[10]ZHENG H X,GE D B,WEI B.Two dimension anisotropic coated object rcs computed by FDTD algorithm [J].Systems Engineering and Electronics,2003,25(1):4-8.
郑宏兴,葛德彪,魏兵.用FDTD 方法计算二维各向异性涂层目标的RCS[J].系统工程与电子技术,2003,25(1):4-8.
[11]SMYTHE W R.Static and dynamic electrcity[M].New York :McGraw-Hill,1968,29-30.
[12]LI Y L,HUANG J Y.Investigation of electric field inside and outside an anisotropic medium sphere [J].Chinese Physics B,2009,18(6):2640-2646.
[13]LI Ying-le,HUANG Ji-ying.Scales transformation theory of electromagnetic field and its applications [M].Xi'an:xidian university press,2006:102-116.
李应乐,黄际英.电磁场的多尺度变换理论及其应用[M].西安：西安电子科技大学出版社,2006:102-116.
[14]ISHIMARU A.Wave propagation and scattering in random medium,part I[M].New York :Academic Press,27-30.

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