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NURBS曲面建模的电大目标的宽带RCS快速计算

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Fast Computation of Wideband RCS of Electrically Large Targets Modeled with NURBS Surfaces

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摘要 该文采用物理光学方法(PO)，快速计算了非均匀有理B样条 (NURBS) 曲面建模的电大目标的时域瞬态散射和宽带雷达截面(RCS)。通过对频域物理光学散射场表达式进行逆傅里叶变换推导出卷积形式的瞬态散射表达式；对频域物理光学积分进行逆傅里叶变换得到时域物理光学积分的表达式。为了避免数值积分的使用，将NURBS曲面等参数离散为一组三角面片，运用Radon变换得到了时域和频域物理光学积分的精确闭式表达式。遮挡消隐时使用改进的z-buffer方法进行了加速。对时域瞬态散射场快速傅里叶变换得到目标的宽带RCS。文中计算了高斯脉冲平面波入射下模型的瞬态散射响应和宽带RCS，数值结果表明该文方法具有很高的计算精度，且计算速度快于传统时域物理光学法(TDPO)。

关键词： 宽频带RCS NURBS曲面 时域物理光学积分 Radon变换 z-buffer算法

Abstract： The Physical Optics (PO) algorithm is utilized to compute the transient scattering response and wideband Radar Cross Section (RCS) of electrically large targets modeled with NonUniform Rational B-Spline (NURBS) surfaces. The formula for the time-domain scattered field is obtained with an inverse Fourier transform, which contains a convolution product. The time-domain PO integral is also derived with the inverse Fourier transform. In order to avoid the utilization of numerical integrations, the NURBS surfaces are discretized into small triangular facets, and Radon transform is introduced to obtain closed-form expressions for the time-domain and frequency-domain PO integrals. The improved z-buffer technique is used in the judgement and elimination of shadows for the sake of acceleration. The wideband RCS is obtained with the Fast Fourier Transform (FFT). The RCS of several targets is calculated under Gaussian-pulse plane wave incidence. Results show that the proposed method has a high accuracy and is faster than the traditional Time-Domain Physical Optics (TDPO).

Keywords： Wideband RCS NURBS surfaces Time-Domain PO (TDPO) integral Radon transform z-buffer algorithm

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