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论文

基于Fournier Forand体积散射函数的水中激光脉冲后向散射特性分析模型

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摘要:

基于Fournier Forand体积散射函数,建立了一种水中激光脉冲后向散射仿真模型.运用该模型可用Monte Carlo方法模拟光子在水中的传播过程,并得到光波后向散射的冲击响应.将初始激光脉冲与冲击响应进行卷积并求其傅里叶谱,即可得到激光脉冲后向散射信号的时域和频域特征.利用该模型分析了入射为高斯型激光脉冲时,水中散射体的尺度分布、散射体与纯水的相对折射率以及水体衰减系数对激光脉冲后向散射特性的影响.结果表明:随着小尺度散射体相对数量的增多、散射体与纯水相对折射率的增加、水体衰减系数的增大,激光脉冲后向散射信号能量增强,宽度增加,低频分量显著增大.

关键词: 水下探测 后向散射 Monte Carlo方法 激光脉冲

A Simulated Model for Analyzing Backscattering of Laser Pulse Propagating in Water Based on Fournier Forand Volume Scattering Function

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Abstract:

Based on Fournier Forand volume scattering function,a simulated model was built to analyze the backscattering properties of laser pulse propagating in water.In this model,in order to obtain light's impulse response of backscattering in water,Monte Carlo method was used to simulate the process of photon's propagating.Then,the initial laser pulse and the impulse response were convolved,and the convolution result Fourier spectral was calculated to get the time- and frequency-domain characteristic of the laser pulse's backscattering signal.Using this model,the influence of the size distribution of scatterer,the relative refractive index of scatterer to water and the attenuation coefficient on the backscattering properties of laser pulse propagating in water was analyzed when the initial laser pulse was approximated by Gaussian function.The result shows that,with the increase of the relative amount of small scatterer,the relative refractive index of scatterer to water and the attenuation coefficient,the energy of the backscattering signal is enhanced,the width is broadened ,and the low frequency component is increased notably.

Keywords: Underwater detection Backscatter Monte Carlo method Laser pulse

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