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矩形隧道中电波传播特性预测

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Predicting Radio Wave Propagation Characteristics in Rectangular Tunnels

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- 摘要
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摘要

电波传播特性预测是无线电系统设计的基础，其中路径损耗特性关系到系统覆盖范围，决定系统布局，时延特性决定数字通信系统的最大数据传输速率.提出一种预测矩形隧道中电波传播特性的方法，该方法可以通过几何光学原理精确地计算出由发射天线到达接收天线的电波主要路径，避免了复杂度很高的射线跟踪过程，使传统预测方法的计算复杂度大大降低.仿真结果表明：该模型对电波传播的路径损耗预测精度不低于传统的射线跟踪方法；隧道环境中收发天线相距越近，其接收的多径信号的平均时延扩散与均方根（root mean square， RMS）时延扩散越大；隧道截面积越大，其接收的多径信号的平均时延扩散与RMS时延扩散越大.

关键词： 传播特性；路径损耗；均方根时延扩散；射线跟踪

Abstract:

It is important to predict characteristics of radio wave propagation. The path loss characteristic has close correlation with coverage and layout of a radio system. The time delay characteristic determines the maximum transmission rate of a radio digital system. In this paper, a new model is presented to predict wave propagation in rectangular tunnels with a rectangular section. In an rectangular tunnel, paths between transmitter and receiver can be determined analytically using geometric optics. The method avoids complicated ray tracing calculation. From the simulation results, accuracy of the prediction is better than ray tracing. The less the separation between transmitter and receiver, the larger the root mean square (RMS) delay spread and mean excess delay. The larger the dimension of cross section, the larger the RMS delay spread and the mean excess delay.

Keywords: propagation characteristics; path loss; root mean square (RMS) time delay spread; ray tracing

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