基于 MATLAB 的超宽带室内信道模型及仿真

摘　要

无线的超宽带技术是短距离通信领域的一颗新星，相较于与以往常规的通信方法有很大的差别。传统的超宽带无线电通信系统使用基带脉冲的传输技术，其拥有许多的优势和发展潜力，例如超高的测距精度和空间频谱效率、较低的功耗成本、以及较小的体积等。但是经典的超宽带无线通信技术还存在着其他的问题，需要面对不同的挑战。本文采用理论分析和仿真比较的方法研究几种调制方法的信号及其在不同信道环境下的传输，模拟了IEEE 802.15.3a 标准信道冲激响应。从多种角度出发研究分析了无线信道的特征和超宽带的信道模型特征参数的不同情况。

通过比较四种不同的仿真条件下的不同的模拟测试结果，最终能够得到一些结论，例如当收发机距离一致的时候，不同条件下的信号传播环境对于信号的时延问题会产生相对应的不同程度的影响，尤其是无线信号在传输过程中是否被遮挡物所阻挡，而在一般情况下得视距（LOS）会比非视距（NLOS）信号传输环境得时延更小，在这两种不同条件下的信道功率延迟剖面显示出信号成簇到达的趋向。在 NLOS 的传播环境中，信号的衰减和延迟这两种现象都是与收发机距离（（从 2 增加至 8 m））成正比；在极端 NLOS 环境中，通常会存在多径信号之间的交错重叠，这使得整个信道都变得不够明显，在实际的信息通信过程中应当极力避免这种情况的产生。下一步还需对模型在室内 LOS 信道环境下的性能进行验证，使其更能充分反应超宽带信道环境。

关键词：超宽带；室内信道模型；仿真

Abstract

As an emerging wireless communication technology, UWB technology is quite different from traditional communication methods. The classic ultra-wideband radio communication system uses baseband pulse transmission technology. It has many advantages and potentials such as high spatial spectrum efficiency, high ranging accuracy, low power consumption, low cost, and small size, but it also faces other challenges in many aspects. In this paper, the methods of theoretical analysis and simulation comparison are used to study the signals of several modulation methods and their transmission in different channel environments. The characteristics of the wireless channel and the characteristic parameters of the UWB channel model are analyzed from different aspects. The IEEE 802.15.3a standard channel impulse response is simulated.

The comparison of the simulation results under the four simulation conditions shows that under the same transceiver distance, the transmission delay of the signal is larger in the NLOS case than in the LOS environment. The power delay profile of the channel in both environments is signals can be faintly observed in clusters. In the NLOS environment, the signal attenuation and delay increase with the distance of the transceiver (from 2m to 8m). In the extreme NLOS propagation environment, the multipath signal Overlap each other, making the entire channel inconspicuous. In actual communication, try to avoid this situation. The next step is to verify the performance of the model under the indoor LOS channel environment, so that it can fully reflect the UWB channel environment.

Key words: Ultra-wideband; indoor channel model; simulation