

# Wide-Band Channel Simulation for OFDM Wireless Systems

賴雅雯、李金椿

E-mail: 9707276@mail.dyu.edu.tw

## ABSTRACT

This thesis utilizes Tapped delay line (TDL) to simulate the wireless wide-band channel, as well as the principle of Rice process generated by a finite sum of weighted sinusoids and Monte Carlo law to simulate the statistics characteristic. This thesis also compares two kinds of methods. According to the statistics characteristic the signal appears Rayleigh Distribution and Rician Distribution, the result of simulation can know the signal has frequency selective fading, multipaths, probability density function (PDF) and the PDF accord with Rayleigh and Rician. According to the result of the principle of Rice process generated by a finite sum of weighted sinusoids, the measure of calculation is smaller, but the weakness is to have periods and the random isn't enough. And the emulation of the Monte Carlo method has better performance to the random, which utilizes an approximate formula of the kind zero-order modified Bessel function [13], but the weakness is to measure of calculation is bigger, and K factor makes the 10 error margin bigger. This thesis simulate two kinds of channel fading for wireless wide-band channel and also have better performance which is easy to realize

Keywords : wireless wide-band channel simulation ; OFDM ; Rician ; Rayleigh ; Monte Carlo

## Table of Contents

封面內頁 簽名頁 授權書 . . . . .	iii	中文摘要 . . . . .	
. . . . .	iv	英文摘要 . . . . .	v
. . . . .	vi	目錄 . . . . .	
. . . . .	vii	圖目錄 . . . . .	ix
. . . . .	xi	表目錄 . . . . .	
. . . . .		第一章 緒論 . . . . .	1
. . . . .		第二章 無線通道 . . . . .	
. . . . .		4.2.1 基本傳輸概論 . . . . .	4.2.2
通道衰變形式 . . . . .	5	2.2.1 路徑損失(Path Loss) . . . . .	
. . . . .	7	2.2.2 遮蔽效應(Shadowing Effect) . . . . .	8
. . . . .	10	2.2.3 多重路徑效應 . . . . .	
. . . . .	10	2.3 瑞雷分布(Rayleigh Distribution) . . . . .	13
. . . . .	14	2.5 都普勒效應 . . . . .	15
. . . . .	17	第三章 OFDM訊號與頻譜 . . . . .	18
OFDM和傳統的分頻多工系統 . . . . .	21	3.1 多載波調變原理 . . . . .	18
. . . . .	23	3.2 . . . . .	3.2
. . . . .	23	3.4 OFDM串列與並行概念 . . . . .	29
. . . . .	31	3.5 保護區間和循環前綴 . . . . .	
寬頻通道 . . . . .	34	第四章 寬頻無線通道模擬及分析 . . . . .	34
. . . . .	35	4.1 . . . . .	4.1
. . . . .	35	4.2 寬頻通道模擬 . . . . .	34
. . . . .	35	4.2.1 通道模型 . . . . .	36
. . . . .	37	4.2.2 正弦波疊加法 . . . . .	36
. . . . .	37	4.2.3 Monte Carlo法 . . . . .	38
. . . . .	40	4.3 模擬結果 . . . . .	38
. . . . .	40	4.3.1 正弦波疊加法模擬結果 . . . . .	40
. . . . .	40	4.3.2 Monte Carlo法模擬結果 . . . . .	44
. . . . .	44	第五章 結論 . . . . .	
. . . . .	48	參考文獻 . . . . .	49

## REFERENCES

[1] Salzberg, B. R., " Performance of an efficient parallel data transmission system " , IEEE Trans. Commun, 1967.  
[2] Weinstein, S.B.,and P. M. Ebert, " Data Transmission by Frequency Division Multiplexing Using the Discrete Fourier Transform " , IEEE Trans. Commun., 1971 [3] R. V. Nee and R. Prasad, " OFDM for Wireless Multimedia communications " , Artech House, 1999 [4] Neng Wang and Steven D. Blostein, " Adaptive Zero-Padding OFDM over Frequency-Selective Multipath " , Aug21, 2003.  
[5] Ding-Bing Lin, Juin-Hau Shiu, and Hsin-Piao Lin, " Design of High-Speed Frequency Selective Fading Channel Simulator by Using Table Look-Up Techniques " , Institute of Computer, Communication and Control, 2003 [6] Ding-Bing Lin, Hsin-Piao Lin, Juin-Hau Shiu, " Simulation of Frequency Selective Fading Channel by Using Deterministic Simulation Model " , Proceedings of National Symposium on

telecom. Taiwan, 2002.

[7] W. C. Jake, Ed., " Microwave Mobile Communications Piscataway " , IEEE Press, 1993.

[8] Matthias Patzold. A Deterministic Digital Simulation Model for Suzuki Processed with Application to a Shadowed Rayleigh Land Mobile Radio Channel. IEEE Trans. 1996.

[9] 劉允中, " Channel Estimations Schemes for OFDM Radio Systems With Pilot Channels " , 大葉大學, 2004.

[10] Rappaport, T. S., " Wireless Communications " , Upper Saddle River, Prentice-Hall, 1996.

[11] 楊嘉豪, " Performance Simulation of DS-CDMA and OFDM Combined System in Radio Fading Channel " , 大葉大學, 2005.

[12] 李志鵬,江弘志,林垂彩, " WCDMA 基頻訊號處理與系統設計實務 " , 滄海書局, 2007.

[13] Zou W. Y., and Yiyang Wu, " COFDM:An overview, " IEEE Trans. on Broadcasting, 1995 [14] PATZOLD M, KILLAT U, LAUE F, " On the statistical properties of deterministic simulation models for mobile fading channels. " IEEE Transactions on Vehicular Technology, 1998.

[15] J. S. Lee and L. E. Miller, " CDMA systems engineering handbook " , ArtechHouse. 2001.