

直序分碼多工擷取下差分相位解調之非同調偵測

賴昱廷、楊新雄

E-mail: 9121506@mail.dyu.edu.tw

摘要

在本論文裡我們探討多訊符相差偵測 (Multiple Symbol Differential Detection) 及 Viterbi解碼相差偵測 (Viterbi-decoding Differential Detection) 應用於 DS-CDMA 系統之可行性，多訊符相差偵測在 AWGN 通道為一種有效的非同調解調方式，若考慮 MPSK 調變器，此種方法所得到的性能比非常趨近同調檢測，然而在 frequency-selective fading 中，探討其可行性之研究並不多，本論文研究將多訊符序列偵測結合耙式接收器 (Rake receiver) 來做信號的解調方法。傳統上，耙式接收器有兩種的解調方式，一為同調檢測，另一為非同調檢測。在同調的解調方式上，每一耙式接收器的路徑均須做通道估測，優點為性能比的提昇，缺點為複雜度與運算量的增加，相反的，在非同調的解調系統中，相對於同調解調則是性能比的衰退與複雜度的簡化，我們建議了一種多訊符序列偵測耙式接收器，針對一個 DS-CDMA 系統，我們進行電腦模擬研究，研究結果顯示，若僅考慮應判決之解碼器，耙式接收器的路徑越多與解調器的多訊符決定區間越長，性能比將越好，這在傳統一個訊符的相差解調是不會發生的。更進一步地，我們在利用 Viterbi解碼相差偵測，這種在多個狀態之後才做決定的方式，使我們整個系統的效能得到最佳的改善。

關鍵詞：直序分碼多工擷取系統；差分相位解調；非同調偵測；多訊符相差偵測；耙式接收機

目錄

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
目錄	ix	Chapter 1 Introduction	
. 1.1 System Overview	1	1.2 Direct Sequence Spread Spectrum	
. 1.3 Equivalent Low-Pass Representation	3	1.4 Problem Specification and Methodology Overview	4
Chapter 2 Characteristics of the Mobile Radio Channel	6	2.1 Introduction	
. 2.2 The Bello Functions	7	2.3 Different Channel Types	
. 2.4 Typical Properties of the Channel	12	2.4.1 Rayleigh Fading Distributions	15
. 2.4.2 Doppler Spreading	17	2.5 The Tapped Delay Line Channel	21
Chapter 3 The Background of the Rake Receiver	24	3.1 The Optimum Coherent Rake Receiver	24
. 3.2 Rake receiver for Differential Detection	30	3.3 Performance of a Rake receiver	32
Chapter 4 Modified Differential Detection of MDPSK	38	4.1 Introduction	38
. 4.2 Multiple-Symbol Differential Detection of MDPSK (MSDD)	39	4.3 Viterbi-decoding differential detection of MDPSK (VDDDD)	45
Chapter 5 The Simulation Results	50	5.1 The System Configuration	50
. 5.2 The Simulation Tool MATLAB	52	5.3 The Simulated Channel Model	54
. 5.4 Convolutional Encoder and Viterbi Decoder	55	5.5 Differentially Coherent Demodulation for MDPSK (DCMDPSK)	59
. 5.6 Rake Receiver with MSDD / VDDDD (L=1, 2)	62	Chapter 6 Conclusions	66
Reference	68		

參考文獻

- [1]. Abrardo, G. Benelli, and G. Cau, " Multiple-symbol differential detection of GMSK, " Electronics Letters, Vol. 29. No. 25, pp. 2167-2168. 9th December 1993.
- [2]. D. Divsalar and M. K. Simon, " Multiple trellis coded modulation (MTCM), " JPL Publ. 86-44 (MSAT-X Rep. 141), Nov. 15, 1986. Also, IEEE Trans. Commun., vol. 36, pp. 4310-419, Apr. 1988.
- [3]. D. Divsalar, and M. K. Simon, " Multiple Symbol Differential Detection of Uncoded and Trellis Coded MDPSK, " Technical Report, Jet Propulsion Laboratory, JPL 89-38, November 1989.
- [4]. D. Divsalar and M. K. Simon, " Multiple-symbol differential detection of MDPSK. " IEEE Trans. Commun., Vol. 38. No. 3, pp. 300-308,

March 1990.

- [5]. F. Adachi and M. Sawahashi, " Viterbi Decoding Differential Detection of DPSK, " Electronics Letters, vol. 28, no. 23, pp. 2196-2198, 5th Nov. 1992.
- [6]. G. M. Vitetta and D. P. Taylor, " Maximum Likelihood Sequence Estimation of Uncoded and Coded PSK Signals Transmitted over Rayleigh Flat-Fading Channels, " Conf. Rec. ICC'94, pp. 1-7, New Orleans, Louisiana, May 1994.
- [7]. G. M. Vitetta and D. P. Taylor, " Viterbi decoding differentially encoded PSK signals transmitted over Rayleigh frequency-flat fading channels, " IEEE Trans. Commun., vol. 43, pp. 1256-1259, Feb./Mar./Apr. 1995.
- [8]. H. Leib, " Data-aided noncoherent demodulation of DPSK, " IEEE Trans. Commun., vol. 43, pp. 722-725, Feb./Mar./Apr. 1995.
- [9]. J. Viterbi, " When not to spread spectrum-A sequel, " IEEE Commun. Mag., vol. 23, no. 4, pp. 12-17, Apr. 1985.
- [10]. John G. Proakis, Digital Communications, 3rd edition, McGraw-Hill, New York, 1995.
- [11]. K. Yu and P. Ho, " Trellis Coded Modulation with Multiple Symbol Differential Detection, " Conf. Rec. ICC ' 93, pp. 1414-1418, Geneva, Switzerland, May 1993.
- [12]. Phillip Bello, " Time-Frequency Duality " , IEEE Transactions on Information Theory, vol. IT-10, pp. 18-33, January 1964.
- [13]. P. Ho and D. K. P. Fung, " Error performance of multiple symbol differential detection of PSK signals transmitted over correlated Rayleigh fading channels, " IEEE Trans Commun., vol. 40, pp. 1566-1568, Oct. 1992.
- [14]. P. Schramm, " Differentially coherent demodulation for differential BPSK in spread spectrum systems, " Vehicular Technology, IEEE Trans., vol. 48.5, pp. 1650-1656, Sep. 1999.
- [15]. R. Price, and P. E. Green, Jr., " A Communication Technique for Multipath Channels " , Proceedings of the IRE, vol. 46, pp. 555-570, March 1958.
- [16]. Raymond Steele (ed.), Mobile Radio Communications, Pentech Press, London, 1992.
- [17]. S. Haykin, Adaptive Filter Theory, 3rd ed. Englewood Cliffs, NJ: Prentice-Hall, 1996.
- [18]. W. C. Jakes, Microwave Mobile Communications, John Wiley & Sons, New York, 1974.