Capacity Evaluation of the W-CDMA Downlink Systems

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ABSTRACT

The performance of the downlink transmission in the third generation mobile radio communication system, wide-band Code Division Multiple Access (W-CDMA), is analyzed for a radio channel having path loss, shadowing effect and multipath fading, and the performance difference between the system with and without RAKE receiver is also considered. Based on the outage probability of the downlink transmission system, the capacity is evaluated according, and a system simulation using Matlab is also performed to verify our analytical results. In our analysis, we begin with a radio channel having only path loss and shadowing effect. The intracellular interference is zero, due to the orthogonally of channelization codes, and therefore the only interference source is intercellular interference. Next the effect of multipath fading is considered for the system with and without RAKE receivers. Without RAKE receivers, as the multipath components of the intracellular interference can not maintain orthogonaling with the signal component, the capacity decrease due to the increase of intracellular interference. The capacity loss due to multipath effect is 25%、38%、61%、52%、13%、28%、25%for R0~R7, respectively. When RAKE receiver and maximum ratio combining are introduced into the system, the signal to interference ratio of the combined signal is significant improved, and the capacity is increase 24%、26%、34%、48%、63%、56%、42%、60%for R0~R7, respectively. Finally, a downlink system having a spreading factor of 32 is used for system simulation, and the result is compared with numerical analysis.

Keywords : W-CDMA ; capacity ; outage probability

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Capacity Evaluation of the W-CDMA Downlink Systems 指導教授: 李金椿 指導教授(英文姓名): C.C. Lee 學位類別: 碩士 校院名稱: 大葉大學　系所名稱: 電機工程學系碩士班 學號: R9003041 學年度: 91 語文別: 中文 論文頁數: 65 關鍵詞: 寬頻劃碼多重存取 ; 通訊容量 ; 中斷率 英文關鍵詞: W-CDMA ; capacity ; outage probability 被引用次數: 1 [摘要] 本文針對第三代無線通訊系統(W-CDMA)，分析其下鏈系統在不同的傳輸速率及負載量下之效能，所考慮的無線通道包含路徑損失(path loss)、遮蔽效應(shadowing effect)及多重路徑干擾(multipath fading)，同時也比較使用與未使用RAKE接收機之效能差異。其次我們藉由通訊中斷率(outage probability)來評估系統容量，最後並使用Matlab模擬驗證。 首先考慮路徑損失、遮蔽效應的影響，由於通道區隔碼相互正交，細胞內干擾為零，所以只考慮細胞間干擾。接著考慮多重路徑干擾的影響，在未使用RAKE接收機情況下，由於通道區隔碼無法完全正交，細胞內干擾增加，造成R0~R7通訊容量分別降低25%、38%、61%、52%、13%、28%、25%。當使用RAKE接收機與最大比例組合(Maximum Ratio Combining)時，組合後信號干擾比大幅改善，使得通訊容量反而增加了24%、26%、34%、48%、63%、56%、42%、60%。 最後使用Matlab，模擬展頻因素為32時的通訊容量，並與數值分析的通訊容量比較。

[英文摘要] The performance of the downlink transmission in the third generation mobile radio communication system, wide-band Code Division Multiple Access (W-CDMA), is analyzed for a radio channel having path loss, shadowing effect and multipath fading, and the performance difference between the system with and without RAKE receiver is also considered. Based on the outage probability of the downlink transmission system, the capacity is evaluated according, and a system simulation using Matlab is also performed to verify our analytical results. In our analysis, we begin with a radio channel having only path loss and shadowing effect. The intracellular interference is zero, due to the orthogonally of channelization codes, and therefore the only interference source is intercellular interference. Next the effect of multipath fading is considered for the system with and without RAKE receivers. Without RAKE receivers, as the multipath components of the intracellular interference can not maintain orthogonaling with the signal component, the capacity decrease due to the increase of intracellular interference. The capacity loss due to multipath effect is 25%、38%、61%、52%、13%、28%、25%for R0~R7, respectively. When RAKE receiver and maximum ratio combining are introduced into the system, the signal to interference ratio of the combined signal is significant improved, and the capacity is increase 24%、26%、34%、48%、63%、56%、42%、60%for R0~R7, respectively. Finally, a downlink system having a spreading factor of 32 is used for system simulation, and the result is compared with numerical analysis.

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