بسم الله الرحمن الرحيم

قال تعالى:

(قالوا سبحانك لا علم لنا الا ما علمتنا انك انت العليم الحكيم)

سورة البقرة (32)

Dedication

To the light in our hearts...

Our Mothers

To the voice in our heads...

Our Fathers

To the joy of our lives...

Our Siblings

Acknowledgement:

First of all, we are very grateful to the God for the good health and wellbeing that were necessary to complete this book.

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Abstract:

To minimize the degradation in system performance caused by the channel, channel estimation must be performed to remove the effects of the channel. To aid the channel estimation process, known pilot subcarriers are embedded into each OFDM symbol and used by the receiver to measure the channel.

This Study will take into account different channel conditions, and try to illustrate their effects on the channel estimation algorithms that will be used, and figure out which appropriate algorithm must apply for each case.

First it's introduces how subcarrier permutation is applied in mobile WiMAX, and given a brief description of its types and modes. Then the estimation process in each modes will be discussed and analysed to compare between them in different channel condition.

المستخلص:

لتقليل ضعف الخدمة في اداء النظامالناتج بواسطة القناة , يجب توقع تأثير القناة لإزالة مؤثرات القناة على البيانات ، و حتى يتم ذلك يجب إضافة إشارات معلومة القيمة مسبقا تسمى pilot الى كل حزمة من حزم الارسال .
في هذه الدراسة سيأخذ في الحسبان ظروف القناة المختلفة و توضيح تاثيراتها على خوارزميات التنبؤ بالقناة المراد استخدامها ومعرفة الخوارزمية المناسبة في كل حالة.

في البداية يجب توضيح طريقة توزيع القنوات الجزئية على المستخدمين في أنظمة الاتصالات اللاسلكية . بعد ذلك سيتم تحليل و مقارنة عدة خوارزميات تعمل على التنبؤ بحالة القناة الناقلة في كل طريقة من تلك الطرق.

Contents:

List of Symbols:

P	Number of signal paths
Rt	Time-domain correlation function
MSE_A	Mean-squared error at (t,k) ϵA , where A={(1,0),(1,3)}
MSE_B	Average mean-squared error for {(t,k), (t,k+1)} ϵ Bt for t = {0,2}
MSE_C	Mean-squared error at (t,k) ϵ C , where C={(1,1),(1,2)}
$\hat{H}$ (t, k)	Estimated Channel Coefficient
Y (t, k)	Received Pilot Signal
X (t, k)	Transmitted Pilot Signal
A	Pilot Constellation Points Magnitude
$MSE_{LI\text{-}PUSC}$	The average MSE in a PUSC tile for Linear Interpolation
MSE_{4avg}	The average MSE within the PUSC tile for 4-Pilot averaging
MSE_D(t, k)	The MSE at each data subcarrier D
σ^2_H	The total average power of the channel impulse response
Rf	Frequency-domain correlation function
RH	Channel auto-correlation function
Δf	Subcarrier frequency spacing
$\hat{h}[m]$	Channel Estimated Coefficient in time domain
L	Rectangular Window Length
w[m]	Rectangular Window
$\hat{h}_{fs}[m]$	Windowed Channel Estimated Response for Frequency Smoothing Algorithm
MSE_{FS}	The average MSE at each subcarrier within the AMC Subchannel for Frequency Smoothing
M	The Total Number of Subcarrierswithin the AMC Subchannel
T_i	The delay of the i^{th} path
n	The Sampling Factor
αi (t)	The Complex Tap Gain
IFFT/ FFT	Inverse Fast Fourier Transform/ Fast Fourier Transform

List of Abbreviations:

WiMAX	Worldwide Interoperability for Microwave Access
DSL	Digital Subscriber Line
FDMA	FrequencyDivision Multiplexing Access
TDMA	TimeDivision Multiplexing Access
CDMA	CodeDivision Multiplexing Access
ISI	Inter Symbol Interference
OFDM	Orthogonal FrequencyDivision Multiplexing
PUSC	Partial Usage of Sub-carriers
FUSC	Full Usage of Sub-carriers
AMC	Adaptive Modulation and coding
IEEE	Institute of Electrical and Electronics Engineering
MIMO	Multiple Input Multiple Output Antenna Systems
OFDMA	Orthogonal Frequency Division Multiple Access
NWG	Network Working Group
LS	LeastSquare
MMSE	The Minimum Mean-Square Error
AWGN	Additive White Gaussian Noise
SNR	Signal-to-Noise Ratio
MSE	Mean Square Error
LOS	Line-Of-Sight
NLOS	Non-Line-Of-Sight
QAM	Quadrature Amplitude Modulation
BER	Bit Error Rate
DFT	Discrete Fourier Transform
IDFT	Inverse Discrete Fourier Transform
FFT	Fast Fourier Transform
IFFT	Inverse Fast Fourier Transform
FATI	The frequency-averaging-time-interpolation
TDI	The Time-Domain-Interpolation
LI	Linear Interpolation
FEC	Forward Error Correction
AAS	Advanced Antenna Systems
MAC	Media Access Control

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