PEAK POWER CONTROL IN MULTICARRIER COMMUNICATIONS

The implementation of multicarrier (MC) modulation in wireless and wireline communication systems, such as OFDM and DMT, is restricted by peak signal power, due to a sensitivity of the technique to distortions introduced by nonlinear devices. By controlling the peak power, the negative influence of signals with high peaks on the performance of the transmission system is greatly reduced. This book describes the tools necessary for analyzing and controlling the peak-to-average power ratio in MC systems, and how these techniques are applied in practical designs. The author starts with an overview of MC signals and basic tools and algorithms, before discussing properties of MC signals in detail: discrete and continuous maxima; statistical distribution of peak power, and codes with constant peak-to-average power ratio are all covered, concluding with methods to decrease peak power in MC systems. Current knowledge, problems, methods, and definitions are summarized using rigorous mathematics, with an overview of tools for the engineer. This book is aimed at graduate students and researchers in electrical engineering, computer science, and applied mathematics, as well as practitioners in the telecommunications industry. Further information on this title is available at www.cambridge.org/9780521855969.

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To the memory of my mother.

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Abbreviations

ACE	active constellation extension
ACI	adjacent channel interference
ACPR	adjacent channel power ratio
ADC	analog-to-digital converter
AM/PM	amplitude modulation/phase modulation
BCH	Bose–Chaudhuri–Hocquenghem (codes)
BER	bit error rate
(B)PSK	(binary) phase-shift keying
BS	block scaling
CCDF	complementary cumulative distribution function
CDMA	code division multiple access
CF	crest factor
CS	codes of strength
DAB	digital audio broadcasting
DAC	digital-to-analog converter
DC	direct current
(I)DFT	(inverse) discrete Fourier transform
DMT	discrete multitone
(A/H)DSL	(asymmetric/high speed) digital subscriber line
DVB	digital video broadcasting
EVM	error vector magnitude
(I)FFT	(inverse) fast Fourier transform
GI	guard interval
HIPERLAN	high performance radio local area network
HPA	high-power amplifier
IBO/OBO	input/output back-off
ICI	inter-carrier interference
ISI	inter-symbol interference

LDPC	low-density parity-check (codes)
LPF	low-pass filter
MC	multicarrier
MIMO	multiple-input multiple-output
OFDM	orthgonal frequency division multiplexing
OFDMA	orthgonal frequency division multiple access
PAPR	peak-to-average power ratio
PMEPR	peak-to-mean envelope power ratio
(Q)PSK	(quadrature) phase-shift keying
PRC	peak reduction carriers
PTS	partial transmit sequences
QAM	quadrature amplitude modulation
RM	Reed–Muller (codes)
RP	random phasor
RS	Reed–Solomon (codes)
SER	symbol error rate
SI	side information
SLM	selective mapping
SL	soft limiter
SNR	signal-to-noise ratio
SSPA	solid-state power amplifier
TI	tone injection
TS	trellis shaping
TWTA	traveling-wave tube amplifier
UWB	ultra wide band
WLAN	wireless local area network
WMAN	wireless metropolitan area network
WPAN	wireless personal area network

Notation

$\mathbb{Z}$	integer numbers
$\mathbb{N}$	natural numbers
$\mathbb{R}$	real numbers
$\mathbb{C}$	complex numbers
$\mathbb{F}$	finite field
$\Re(\cdot)$	real part
$\Im(\cdot)$	imaginary part
$\imath$	$\sqrt{-1}$
a^*	complex conjugate of $a \in \mathbb{C}$
$\|a\|$	absolute value of $a \in \mathbb{C}$
$\arg(a)$	argument of a
$\mathbf{a}$	vector
$(\mathbf{a}, \mathbf{b})$	dot product of vectors $\mathbf{a}$ and $\mathbf{b}$
$\|\mathbf{a}\|$	norm of $\mathbf{a}$
A^t	transposed matrix A
E_{av}	average energy of constellation
$E_{\max}$	maximum energy of a constellation point
f_0	carrier frequency
f_s	tone bandwidth
$\mathcal{M}_c$	continuous maximum
$\mathcal{M}_d$	discrete maximum
g.c.d.	greatest common divisor
i.i.d.	independent identically distributed
p.d.f.	probability density function
p.s.d.	power spectral density
deg	degree of a polynomial
sinh	hyperbolic sine
cosh	hyperbolic cosine
sign	sign