

1. Record Nr.	UNINA9910139570403321
Autore	Primak Serguei
Titolo	Wireless multi-antenna channels : modeling and simulation / / Serguei Primak, Valeri Kontorovich
Pubbl/distr/stampa	Hoboken, New Jersey : , : Wiley, , c2012 [Piscataway, New Jersey] : , : IEEE Xplore, , [2011]
ISBN	1-119-96086-X 1-283-30681-6 9786613306814 1-119-95472-X 1-119-95471-1
Descrizione fisica	1 online resource (273 p.)
Collana	Wireless communications and mobile computing
Classificazione	TEC008000
Altri autori (Persone)	KontorovichV. IA (Valerii IAKovlevich)
Disciplina	621.3845/6
Soggetti	Roaming (Telecommunication) - Mathematical models MIMO systems - Mathematical models Antenna radiation patterns - Mathematical models Antenna arrays - Mathematical models Adaptive antennas - Mathematical models
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	About the Series Editors xi -- 1 Introduction 1 -- 1.1 General remarks 1 -- 1.2 Signals, interference, and types of parallel channels 3 -- 2 Four-parametric model of a SISO channel 7 -- 2.1 Multipath propagation 7 -- 2.2 Random walk approach to modeling of scattering field 13 -- 2.2.1 Random walk in two dimensions as a model for scattering field 13 -- 2.2.2 Phase distribution and scattering strength 14 -- 2.2.3 Distribution of intensity 14 -- 2.2.4 Distribution of the random phase 17 -- 2.3 Gaussian case 18 -- 2.3.1 Four-parametric distribution family 18 -- 2.3.2 Distribution of the magnitude 20 -- 2.3.3 Distribution of the phase 27 -- 2.3.4 Moment generating function, moments and cumulants of four-parametric distribution 29 -- 2.3.5 Some aspects of multiple scattering propagation 29 -- 3 Models of MIMO channels 33 -- 3.1 General classification of MIMO

channel models	33
3.2 Physical models	33
3.2.1 Deterministic models	34
3.2.2 Geometry-based stochastic models	35
3.3 Analytical models	36
3.3.1 Channel matrix model	37
3.4 Geometrical phenomenological models	47
3.4.1 Scattering from rough surfaces	48
3.5 On the role of trigonometric polynomials in analysis and simulation of MIMO channels	49
3.5.1 Measures of dependency	50
3.5.2 Non-negative trigonometric polynomials and their use in estimation of AoD and AoA distribution	51
3.5.3 Approximation of marginal PDF using non-negative polynomials	51
3.6 Canonical expansions of bivariate distributions and the structure MIMO channel covariance matrix	52
3.6.1 Canonical variables and expansion	52
3.6.2 General structure of the full covariance matrix	54
3.6.3 Relationship to other models	54
3.7 Bivariate von Mises distribution with correlated transmit and receive sides	56
3.7.1 Single cluster scenario	56
3.7.2 Multiple clusters scenario	58
3.8 Bivariate uniform distributions	58
3.8.1 Harmonic coupling	58
3.8.2 Markov-type bivariate density	61
3.9 Analytical expression for the diversity measure of an antenna array	62
3.9.1 Relation of the shape of the spatial covariance function to trigonometric moments	62
3.9.2 Approximation of the diversity measure for a large number of antennas	64
3.9.3 Examples	66
3.9.4 Leading term analysis of degrees of freedom	70
3.10 Effect of AoA/AoD dependency on the SDoF	72
3.11 Space-time covariance function	72
3.11.1 Basic equation	72
3.11.2 Approximations	73
3.12 Examples: synthetic data and uniform linear array	75
3.13 Approximation of a matrix by a Toeplitz matrix	77
3.14 Asymptotic expansions of diversity measure	78
3.15 Distributed scattering model	79
4 Modeling of wideband multiple channels	81
4.1 Standard models of channels	82
4.1.1 COST 259/273	82
4.1.2 3GPP SCM	83
4.1.3 WINNER channel models	84
4.2 MDPSS based wideband channel simulator	84
4.2.1 Geometry of the problem	84
4.2.2 Statistical description	85
4.2.3 Multi-cluster environment	87
4.2.4 Simulation of dynamically changing environment	88
4.3 Measurement based simulator	89
4.4 Examples	91
4.4.1 Two cluster model	92
4.4.2 Environment specified by joint AoA/AoD/ToA distribution	93
4.4.3 Measurement based simulator	95
4.5 Appendix A: simulation parameters	96
5 Capacity of communication channels	99
5.1 Introduction	99
5.2 Ergodic capacity of MIMO channel	100
5.2.1 Capacity of a constant (static) MIMO channel	100
5.2.2 Alternative normalization	102
5.2.3 Capacity of a static MIMO channel under different operation modes	103
5.2.4 Ergodic capacity of a random channel	104
5.2.5 Ergodic capacity of MIMO channels	106
5.2.6 Asymptotic analysis of capacity and outage capacity	106
5.3 Effects of MIMO models and their parameters on the predicted capacity of MIMO channels	109
5.3.1 Channel estimation and effective SNR	110
5.3.2 Achievable rates in Rayleigh channels with partial CSI	113
5.3.3 Examples	116
5.4 Time evolution of capacity	119
5.4.1 Time evolution of capacity in SISO channels	119
5.4.2 SISO channel capacity evolution	120
5.5 Sparse MIMO channel model	122
5.6 Statistical properties of capacity	124
5.6.1 Some mathematical expressions	124
5.7 Time-varying statistics	125
5.7.1 Unordered eigenvalues	125
5.7.2 Single cluster capacity LCR and AFD	126
5.7.3 Approximation of multi-cluster capacity LCR and AFD	126
5.7.4 Statistical simulation results	129
6 Estimation and prediction of communication channels	131
6.1 General remarks on estimation of time-varying channels	131
6.2 Velocity estimation	131
6.2.1 Velocity estimation based on the covariance function	

approximation	131
6.2.2 Estimation based on reflection coefficients	132
6.3 K-factor estimation	133
6.3.1 Moment matching estimation	133
6.3.2 I/Q based methods	134
6.4 Estimation of four-parametric distributions	135
6.5 Estimation of narrowband MIMO channels	138
6.5.1 Superimposed pilot estimation scheme	138
6.5.2 LS estimation	140
6.5.3 Scaled least-square (SLS) estimation	142
6.5.4 Minimum MSE	144
6.5.5 Relaxed MMSE estimators	146
6.6 Using frames for channel state estimation	148
6.6.1 Properties of the spectrum of a mobile channel	149
6.6.2 Frames based on DPSS	150
6.6.3 Discrete prolate spheroidal sequences	150
6.6.4 Numerical simulation	154
7 Effects of prediction and estimation errors on performance of communication systems	157
7.1 Kolmogorov / Szegő; o-Krein formula	160
7.2 Prediction error for different antennas and scattering characteristics	162
7.2.1 SISO channel	162
7.2.2 SIMO channel	165
7.2.3 MISO channel	167
7.2.4 MIMO channel	170
7.3 Summary of infinite horizon prediction results	174
7.4 Eigenstructure of two cluster correlation matrix	175
7.5 Preliminary comments on finite horizon prediction	176
7.6 SISO channel prediction	178
7.6.1 Wiener filter	178
7.6.2 Single pilot prediction in a two cluster environment	179
7.6.3 Single cluster prediction with multiple past samples	181
7.6.4 Two cluster prediction with multiple past samples	182
7.6.5 Role of oversampling	187
7.7 What is the narrowband signal for a rectangular array?	188
7.8 Prediction using the UIU model	190
7.8.1 Separable covariance matrix	191
7.8.2 1 x 2 unseparable example	192
7.8.3 Large number of antennas: no noise	193
7.8.4 Large number of antennas: estimation in noise	194
7.8.5 Effects of the number of antennas, scattering geometry, and observation time on the quality of prediction	195
7.9 Numerical simulations	198
7.9.1 SISO channel single cluster	198
7.9.2 Two cluster prediction	198
7.10 Wiener estimator	199
7.11 Approximation of the Wiener filter	201
7.11.1 Zero order approximation	202
7.11.2 Perturbation solution	202
7.12 Element-wise prediction of separable process	203
7.13 Effect of prediction and estimation errors on capacity calculations	204
7.14 Channel estimation and effective SNR	205
7.14.1 System model	205
7.14.2 Estimation error	205
7.14.3 Effective SNR	207
7.15 Achievable rates in Rayleigh channels with partial CSI	208
7.15.1 No CSI at the transmitter	208
7.15.2 Partial CSI at the transmitter	209
7.15.3 Optimization of the frame length	211
7.16 Examples	211
7.16.1 P(0, 0) Estimation	211
7.16.2 Effect of non-uniform scattering	213
7.17 Conclusions	214
7.18 Appendix A: Szegő; o summation formula	215
7.19 Appendix B: matrix inversion lemma	216
8 Coding, modulation, and signaling over multiple channels	219
8.1 Signal constellations and their characteristics	219
8.2 Performance of OSTBC in generalized Gaussian channels and hardening effect	224
8.2.1 Introduction	224
8.2.2 Channel representation	225
8.2.3 Probability of error	227
8.2.4 Hardening effect	229
8.3 Differential time-space modulation (DTSM) and an effective solution for the non-coherent MIMO channel	233
8.3.1 Introduction to DTSM	233
8.3.2 Performance of autocorrelation receiver of DSTM in generalized Gaussian channels	234
8.3.3 Comments on MIMO channel model	235
8.3.4 Differential space-time modulation	235
8.3.5 Performance of DTSM	237
8.3.6 Numerical results and discussions	243
8.3.7 Some comments	243
Bibliography	245
Index	257

"Wireless Multi-Antenna Channels: Modeling and Simulation focuses on modeling and simulation of multiple antennas channels, including multiple input multiple output (MIMO) communication channels and impact of such models on channel estimation and system performance. Both narrowband and wideband models are discussed. The book covers topics related to modeling of MIMO channel, their numerical simulation, estimation and prediction, as well as applications to receive diversity and space-time coding techniques. Contains significant fundamental/background material, as well as novel research coverage, which make the book suitable for both graduate students and researchers Addresses issues such as key-hole, correlated and non i.i. d. channels in the frame of the Generalized Gaussian approach Provides a unique treatment of generalized Gaussian channels and orthogonal channel representation Reviews different interpretations of scattering environment, including geometrical models Focuses on the analytical techniques which give a good insight into the design of systems on higher levels Describes a number of numerical simulators demonstrating the practical use of this material. Accompanying website will contain additional materials and practical examples for self-study"

--

"The book will cover topics related to modeling of MIMO channel, their numerical simulation, estimation and prediction, as well as applications to receive diversity and space-time coding techniques"--
