

CONTENTS

Preface	vii
1 Environmental processes, their measurement and recording	1
1.1 Choice of measuring conditions and measured locations	3
1.2 Recording of measured processes	6
1.2.1 Organization of a measuring chain	6
1.2.2 Organization of a tape record	18
1.2.3 Organization of the measurement	20
2 Evaluation of random process properties.	22
2.1 Random process sampling	25
2.2 Evaluation of occurrences of characteristic parameters	29
2.2.1 The relative peak method	29
2.2.2 The maximum amplitude method	30
2.2.3 The method of the correlation table of extremes	31
2.2.4 The relative range method	34
2.2.5 The relative range and mean method	36
2.2.6 The relative range, mean and frequency methods	37
2.2.7 The rain flow method	39
2.2.8 The level-crossing method	41
2.2.9 The transition probability densities method	42
2.2.10 Statistical relations between parameter occurrences	50
2.3 Evaluation of processes as continuous random quantities	52
2.3.1 Tests for stationarity	53
2.3.2 Evaluation of properties of stationary processes	58
2.3.2.1 Test for randomness	58
2.3.2.2 Evaluation of one-dimensional probability density	61
2.3.2.3 Test for normality	63
2.3.2.4 Evaluation of the autocorrelation function	66
2.3.2.5 Evaluation of the power spectral density	69
2.3.2.6 Tests of difference and equivalence of statistical characteristics	76
2.3.2.7 Confidence intervals for statistical characteristics	81

2.3.3	Evaluation of properties of non-stationary processes	83
2.4	Evaluation of processes as time series	89
3	Simulation of random processes	97
3.1	Generation of random numbers with a given distribution	103
3.2	Simulation of a random process by sinusoidal cycles	108
3.3	Simulation of a random process by sinusoidal half cycles	112
3.4	Simulation of transitions between ordinates	115
3.5	Simulation of local process extremes (envelopes)	117
3.6	Simulation of the statistical characteristics of random processes	121
3.6.1	Simulation of an arbitrarily distributed white noise	125
3.6.2	Simulation of a Gaussian random process power spectral density (auto-correlation function).	145
3.6.2.1	Harmonic analysis of random functions	145
3.6.2.2	Solution of differential equations	150
3.6.2.3	Method of moving summations and method of recurrent difference equations	152
3.6.3	Simulation of power spectral density (autocorrelation function) of an arbitrarily distributed random process	162
3.7	Simulation of non-stationary random processes	168
3.7.1	Simulation of power	168
3.7.2	Simulation of an autocorrelation function	171
3.7.3	Simulation of non-stationary Markov processes	181
3.7.4	Simulation of a time series	187
3.7.5	Simulation of non-stationary processes with a stepwise variable autocorrelation	204
3.7.6	Simulation of stable non-stationary random processes	213
4	Conclusions	225
	References	230
	Subject index	232