

Index

- Absolute jitter
 - and period jitter, 3, 25
 - and phase noise, 52, 66, 183
 - definition, 3, 17, 25
 - from $1/f^2$ phase noise, 55
 - from $1/f^3$ phase noise, 58
 - from flat phase noise, 54
 - from PLL-like phase noise, 56
 - from spectral spurious tones, 66
 - jitter transfer function, 54
 - measurement, 168
 - phase noise integration limits, 53
- Accumulated jitter, 21
- Adjacent period jitter, 24
- Allan Deviation (ADEV), 193
 - and jitter, 195, 197, 199
 - definition, 195
 - estimator, 195
 - from phase noise, 66, 197
 - modified (MDEV), 199
- Allan Variance (AVAR), *see* Allan Deviation
- Analog to Digital Converters (ADC)
 - effective number of bits (ENOB), 129
 - error power for random inputs, 132
 - error power for sinusoidal inputs, 130
 - flash ADC in oversampling converters, 140
 - Nyquist converters, 128
 - oversampling $\Delta\Sigma$ modulators, 139
 - quantization noise, 128
 - spectrum of error signal, 133
 - time skew calibration, 137
 - time-interleaved, 133
- Aperture jitter, 24
- Atomic clocks, 193, 195
- Bit error rate (BER), 143
- Clock and Data Recovery (CDR), 4, 13, 145, 166
 - bang-bang phase detector, 155
 - bang-bang phase detector gain, 157
 - bang-bang quantization error, 158
 - jitter generation, 146, 150
 - jitter peaking, 148, 168
 - jitter tolerance (JTOL), 4, 148, 151, 154
 - jitter tracking, 148
 - jitter transfer, 146
 - limited VCO range, 153
 - linear model, 145, 147, 149–151, 159, 168
 - phase interpolator based, 167, 172
 - stability, 159
- CMOS differential stage
 - jitter, 74
- CMOS inverter
 - random jitter, 10, 73
 - supply induced jitter, 73
- Constant current on capacitor, 9
 - jitter, 69
- Crystal oscillators
 - parallel RLC network approximation, 88
 - Pierce configuration, 87
 - resonance modes, 87
 - time-invariant phase noise analysis, 86
- Cycle jitter, 24
- Cycle-to-Cycle jitter
 - and absolute jitter, 23, 25
 - and period jitter, 23, 25
 - definition, 23, 25
- Deterministic jitter (DJ), 7, 160, 216, 219
 - definition, 36
 - DJ and RJ convolution, 37
 - dual Dirac, 41
 - total DJ, 38
- Digital circuits
 - clock skew, 113
 - edge-triggered, 111
 - gated and enabled systems, 114
 - latch-based, 117
 - metastability, 114
 - MTBF, 114
 - multicycle paths, 116
- Digital to Analog Converters (DAC)
 - integrating capacitor, 126
 - linear filtering, 123
 - NRZ current DAC, 121
 - RZ current DAC, 126
- Duty cycle distortion, 161

- Ergodicity, 28, 232
- Error function, 186
- Error probability, 144
- Excess phase, 206
 - and absolute jitter, 43, 45
 - definition, 16
 - power spectral density, 49
 - voltage to phase conversion, 46, 49
- Eye diagram, 5, 160
 - monitoring, 164
- Figure of Merit (FOM), 83, 101
- Flicker noise
 - at very low frequencies, 201
 - charge trapping theory, 201
 - in oscillators, 103
 - infinite power paradox, 200, 204
 - infinite RC line, 203
 - stationarity, 203, 204
 - ubiquity, 200
 - up-conversion, 92
- Frequency dividers, 104
 - absolute jitter, 105
 - and spurious tones, 107
 - input-output phase noise, 105
 - N-period jitter, 105
- Frequency multipliers, 108
 - absolute jitter, 109
 - input-output jitter, 109
 - N-period jitter, 109
- Frequency stability, 193
 - Allan Deviation, *see* Allan Deviation
 - power laws, 198
 - true variance, 194
- GSM standard, 177, 181
- Hold time, 112, 118
 - constraint on peak jitter, 117
 - definition, 111
- Impulse Sensitivity Function (ISF), 90, 96
 - effective, 93
 - LC tank, 94
- Integrated jitter, 24
- Intentional jitter, 4
 - in CDR, 171
- Jitter
 - absolute, *see* Absolute jitter
 - aliasing, 46
 - and phase noise, 183
 - and phase noise, summary tables, 66
 - as discrete-time random process, 2, 4, 25, 27, 43
 - computation from time vector, 211, 237
 - deterministic, *see* Deterministic jitter
 - generic definition, 15
 - histogram, 27, 28
 - mean, 31, 184
 - median, 31
 - multiple components, 37
 - on data, 5
 - peak, 32, 33
 - peak and non-Gaussian distributions, 34
 - peak and unbounded distributions, 33
 - peak-peak, 32
 - probability density function, 28, 29
 - random, *see* Random jitter
 - spectral spurious tones, 65
 - standard deviation, 32
 - variance, 32
- Jitter amplification, 161
- Jitter decomposition, 7, 39
 - DJ underestimation, 216
 - independent- σ technique, 39
 - tail fitting, 39, 41, 214, 239, 240
- Jitter distribution
 - Dirac, 31
 - dual-Dirac, 30, 40
 - Gaussian, 30, 186
 - sinusoidal, 30
 - uniform, 30
- Jitter estimation, 185
 - confidence interval, 185
 - mean, 186
 - minimum number of samples, 188–191, 193
 - order statistics, 191
 - peak, 191
 - variance, 188
- Jitter generation, *see* Clock and Data Recovery (CDR)
- Jitter mitigation, 163
- Jitter monitoring, 163
- Jitter tolerance, *see* Clock and Data Recovery (CDR)
- Jitter transfer, *see* Clock and Data Recovery (CDR)
- Jitter variance, 184
- LC oscillators
 - class-C, 100
 - Colpitts, 100
 - double-switch, 99
 - phase noise up-conversion, 85
 - single-switch, 99
 - time-invariant phase noise analysis, 84
 - time-variant phase noise analysis, 96
- Leeson's model, 80, 85, 96
- Long-term jitter
 - and period jitter, 63
 - and phase noise, 59
 - and PLL bandwidth, 63
 - definition, 23
 - from PLL-like phase noise, 62
- Maximum Time Interval Error (MTIE)

- and absolute jitter, 22
- definition, 22
- N*-period jitter, *see also* Period jitter
 - and absolute jitter, 20, 25
 - and period jitter, 21, 25
 - and phase noise, 59, 66, 184
 - definition, 3, 20, 25
 - from $1/f^2$ phase noise, 61
 - from $1/f^3$ phase noise, 63
 - from flat phase noise, 60
 - from PLL-like phase noise, 61
 - from spectral spurious tones, 66
 - multiple spectral components, 66
- Narrow angle assumption, 47, 50
- Noise factor F, 82, 84, 96, 98, 99
- Noise figure, 176
- Period jitter, *see also* *N*-period jitter
 - and absolute jitter, 3, 19, 25
 - definition, 2, 19, 25
- Phase jitter, 24
- Phase noise
 - and jitter, summary tables, 66
 - computation from jitter samples, 214, 237
 - definition, 51
 - equivalent noise bandwidth, 56
 - generation of $1/f^2$ profile, 208, 234
 - generation of band-pass profiles, 208, 233
 - generation of complex profiles, 211, 236
 - generation of flat profile, 208, 233
 - generation of flicker profiles, 209, 211, 234, 235
 - harmonics, 49, 206
 - in-band, 56
 - Lorentian spectrum, 205
 - time-variant analysis, 90
- Power Spectral Density (PSD), 45, 228
 - physical meaning, 230
- Q-scale, 42, 215, 239
 - normalized, 42, 217, 240
- Quality factor, 81, 82, 85, 89
 - and FOM, 84
- Random jitter (RJ), 7, 160, 216, 219
 - and bit error rate, 35
 - and Q factor, 41
 - definition, 35
 - RJ and DJ convolution, 37
- total RJ, 38
- Regression line, 214
- Relative jitter
 - and absolute jitter, 18, 25
 - definition, 18, 25
 - measurement, 166
- Relaxation oscillators
 - jitter, 78
- Ring oscillators
 - jitter, 2, 12, 77
 - jitter vs. number of stages, 78
- N*-period jitter, 78
- time-variant phase noise analysis, 93
- Sample mean, 31, 186
 - confidence interval, 187
- Sample variance, 32, 188
 - confidence interval, 189
- Setup time, 111, 118
 - constraint on peak jitter, 113, 116, 119
 - definition, 111
- Short-term jitter, 24
- Sinusoidal jitter (SJ)
 - definition, 36
- Spread Spectrum Clock (SSC), 4, 23
- Spurious to Carrier Ratio (SCR), 50
- Tail fitting, *see* Jitter decomposition
- Time Deviation (TDEV), 199
- Time Error (TE)
 - and absolute jitter, 22
 - definition, 21
- Time Interval Error (TIE)
 - and absolute jitter, 22
 - and *N*-period jitter, 22
 - definition, 21
- Total jitter (TJ)
 - definition, 41
- WCDMA standard, 179
- Wiener process, 70, 205
- Wiener–Khinchin theorem, 203, 227
- Wireless receiver
 - blocker signals, 175
 - reciprocal mixing, 179
 - sensitivity, 176
- Wireless transmitter
 - VCO phase noise requirements, 177