

# Index

Page locators in **bold** indicate tables and those in *italics* indicate figures.

- AACD (augmented autoregressive conditional duration) models, 54
- ACD (autoregressive conditional duration) models, 53–54
- alarm, 6
  - limit, 6, 85, **163**
  - statistic, 15, 223–228, 229
  - time, 6, **109**
  - timeliness, 72, 82
  - trust in, 106, *107*
- ARCH (autoregressive conditional heteroskedasticity) models, 33–34, 41–42, **47**, 154
- ARIMA (autoregressive integrated moving average) models, 42
- ARL, *see* average run length
- ARMA (autoregressive moving average) models, 37–38, 117–118
  - autocovariance functions of, **118**
- augmented autoregressive conditional duration (AACD) models, 54
- autoregressive conditional duration (ACD) models, 53–54
- autoregressive conditional heteroskedasticity (ARCH) models, 33–34, 41–42, **47**, 154
- autoregressive moving average (ARMA) models, 37–38, 117–118
- autoregressive integrated moving average (ARIMA) models, 42
- average run length (ARL), **8**, 9, 122–123, 127–128
  - optimality, 12
  - values for some methods, *128*, *129*, *136*, **164**, **165**
- Bayesian inference, 7, 17, 99
- Black–Scholes rule, 212
- BOX–COX transformation, 54, 215
- Brownian motion, *see* Wiener process
- CED (conditional expected delay), **8**, 10, *105*, 122, 140, **141**, **166**

- change-point problems, 4, *see also* surveillance
- CKLS model, 213, 229–230  
interpretation of parameters, 223
- conditional expected delay (CED), 8, 10, 105, 122, 140, **141, 166**
- conditional heteroskedacity, 41–44
- continuous-time models, 25, 33–34, 62, 212  
diffusions, 47–52  
surveillance, 211–234
- control chart, 5, 206, *see* surveillance
- copulas, 56–57
- covariance matrices  
of a multivariate linear time series, 142–150  
of a multivariate nonlinear time series, 169–175
- critical values, *see* alarm limit
- CUSUM method, 14–15, 79, 99, 121, 124, 133–134, 161–162  
and filter rules, 75–76  
two-sided, 138  
parallel, 21  
for the variance in the presence of autocorrelation, 136  
for the volatility applied to daily returns on MSCI country indices for Germany, US and Japan, 144
- diffusion processes, likelihood approximations for, 214–216
- duration, analysis of, 53–55
- EAR (exponential autoregressive) model, 46
- early warning system, 5, *see also* surveillance
- ED (expected delay) criterion, 11, 97
- efficient market hypothesis, 35, 70
- ergodicity, 36
- evaluation, 7–13  
for hypothesis testing and on-line surveillance, 7–8  
of likelihood-based surveillance of volatility, 93–113  
measures for, 72–74, 96–97  
by return, 19
- EWMA (exponentially weighted moving averages)  
method, 15–16, 121, 175  
multivariate, 172–175  
for the variance, 136  
for residuals, 149–150
- expected delay criterion, 11, 97
- exponential autoregressive model (EAR), 46
- exponentially weighted moving averages, *see* EWMA
- extreme value analysis, 55–57
- false alarms, 20, 96  
controlling, 81–82  
rate of, 9  
probability of, 104
- false discover rate (FDR), 21
- FIGARCH (fractionally integrated GARCH), 43
- filter rules, 75–76, 87
- financial markets problems, 35–36
- fractionally integrated GARCH, 43

- full likelihood ratio method (LR),  
 16–18, 74  
 alarm criterion, 74  
 stopping rule, 100–102  
 time of an alarm, 17
- GARCH (generalized ARCH)  
 model, 42, 43, 79,  
 154–157  
 parameter estimates, **109**  
 multivariate, 170–172
- generalized ARCH model, *see*  
 GARCH
- generalized filter rule (GFR), 76
- generalized likelihood ratio (GLR)  
 method, 15
- GFR (generalized filter rule), 76
- global minimum variance portfolio  
 (GMVP) weights, 180,  
 184–185  
 control charts, 193–195  
 distribution of, 185–187  
 estimated by a rolling  
 window, *180*
- GLR, *see* generalized likelihood  
 ratio
- GMVP, *see* global minimum  
 variance portfolio
- Hang Seng Index (HSI), 80–86  
 hazard function, 53  
 hidden Markov model (HMM), 78  
 hidden Markov rule (HMR), 78,  
**84**
- HMM (hidden Markov model), 78
- HMR method (hidden Markov  
 rule), 78, **84**
- HSI (Hang Seng Index), 80–86
- IGARCH (integrated GARCH), 42  
 integrated GARCH (IGARCH), 42
- Ito integral, 49, 51  
 Ito lemma, 51
- jump processes, 57–59
- Lévy process, 34, 58  
 linear filters, 40  
 LR, *see* full likelihood ratio  
 method (LR)
- Mahalanobis control charts, 194  
 Mahalanobis distance, 148, 194  
 market efficiency, 179
- Markov-switching model, *see*  
 hidden Markov models  
 (HMM)
- median run length (MRL), 9
- MEWMA (multivariate EWMA)  
 method, 22, 194–195,  
**197, 198**
- Milstein scheme, 50
- minimal expected delay, 11
- minimax optimality, 12
- Mixture Likelihood Ratio (MLR)  
 method, 15
- MLR (Mixture Likelihood Ratio),  
 15
- modified CUSUM control charts,  
 124–126, *168*
- modified EWMA control charts,  
 123–124, 147–149, *167*
- modified Shewhart control charts,  
 122–123
- monitoring, 5, *see also*  
 surveillance
- Monte Carlo method, versus case  
 studies, 84
- Morgan Stanley Capital  
 International index, *see*  
 MSCI country index for  
 Germany

- moving average methods, 15, 77–78, 87
- MRL (median run length), 9
- MSCI (Morgan Stanley Capital International) country index for Germany, 166–169
- modified CUSUM control charts, 168
- modified EWMA control charts, 167
- multivariate surveillance, 21–22
- EWMA method, *see* MEWMA method
- surveillance of the covariance matrix of linear time series, 142–152
- surveillance of nonlinear time series, 153–177
- optimal stopping rules, 4, 70
- optimality criteria, 11–12, 96–97
- oscillator method, 87
- parallel CUSUM methods, 21
- PFA (probability of false alarm), 8, 9, 104
- PGARCH (power GARCH), 47
- portfolio analysis, 179
- optimal composition, 181–187
- sequential monitoring of, 179–209
- theory, 181–187
- power GARCH (PGARCH), 47
- predictive value (PV) of an alarm, 11, 106, 107
- probability of false alarm (PFA), 8, 9, 104
- probability of successful detection (PSD), 8, 10, 106
- PSD (probability of successful detection), 8, 10, 106
- PV (predicted value) of an alarm, 11, 106, 107
- quality control, 5, *see also* surveillance
- regime switching model, *see* hidden Markov models (HMM)
- residual control charts, 86, 126–127, 134–135, 160–161, 174–175
- risk, 55
- run length, *see* average run length
- S&P500, *see* Standard and Poor's 500 stock market index
- SACPH (semiparametric autoregressive conditional proportional hazard) models, 54
- SADT (steady state average delay time), 10
- SDE (stochastic differential equations), 48
- self-excited threshold autoregressive (SETAR) model, 45
- semiparametric autoregressive conditional proportional hazard (SACPH) models, 54
- sequential monitoring, *see* surveillance
- SETAR (self-excited threshold autoregressive) model, 45
- Shewhart method, 5, 14, 75, 103–106, 122
- Shiryayev–Roberts (SR) method, 13, 17, 74, 222

- smooth transition autoregressive (STAR), 46
- SR (Shiryaev–Roberts) method, 13, 17, 74, 222  
 Nonparametric (SRnp), 75, 88, *see also* turn detection
- SRnp (SR nonparametric) method, 75, 88, *see also* turn detection
- Standard and Poor's 500 stock market index, 107–110
- STAR (smooth transition autoregressive) model, 46
- statistical models in finance, 31–68
- statistical process control, 5, *see* surveillance
- steady state average delay time (SADT), 10
- Stein estimators, 60
- stochastic differential equations (SDE), 48
- stochastic finance, theory of, 24
- surveillance  
 of continuous-time processes 211–234  
 of conditional covariances, 173–174  
 of the covariance matrix of a multivariate linear time series, 142–150  
 of the covariance matrix of a multivariate nonlinear time series, 169–175  
 of dependent data, 19  
 of discrete distributions, 19  
 for financial decisions, special aspects of, 18–22  
 future of, 236  
 general description, 4–5  
 of GMVP weights, 193–195  
 of gradual changes, 19–20  
 history of, 5–6  
 of linear time series, 115–152  
 methods used as trading rules in finance, 79–80  
 of multivariate data, *see* multivariate  
 of nonlinear time series, 153–177  
 of portfolio weights, 188–190  
 problem specifications, 6–7  
 relation between technical analysis and, 69–92  
 and strategies suggested for technical analysis, 72–80  
 between unknown levels, 20  
 of the variance of a univariate linear time series, 129–142
- surveillance methods, 13  
 CUSUM, *see* CUSUM method  
 EWMA, *see* EWMA method  
 full likelihood ratio (LR), *see* full likelihood ratio method  
 moving average and window-based methods, 15  
 MEWMA, *see* MEWMA method  
 Shewhart, *see* Shewhart method  
 Shiryaev–Roberts, *see* Shiryaev–Roberts method
- TAR (threshold-auto-regressive) model, 45

- Taylor expansions, 230–233
- technical analysis, 23–24
  - relation between statistical surveillance and, 69–92
- threshold-auto-regressive (TAR) model, 45
- timeliness, *see* evaluation
- trading rules, 79–80
- transaction costs, 73
- transition data, analysis of, 53–55
- transition density, 212
- transition probabilities, 84–85
- trend breaking rules, *see* filter rules
- trust, in alarms, *see* predicted value
- turn detection, and the SRnp method, 70–99
- variance
  - of linear time series, 129–142
  - of nonlinear time series, 157–169
  - evaluations of
    - likelihood-based surveillance of, 93–113
  - EWMA type control charts based on, 157–159
  - methods for surveillance, 97–102
- volatility, *see* variance
- Wiener process, 32, 47–48
- window methods, 15, 19
- worst possible case criterion, 12
- Zarnowitz–Moore method, 79