
Index

- χ , 55, 347
- 2-counter machine, 134
- 20-sim, 55, 329, 346, 358
- ABACUSS, 329, 346, 353
- ABS, *see* anti-lock braking system
- abstraction, 62, 71, 72, 193, 228, 424, 443
 - a. refinement, 286
 - discrete a., 43, 230
- abstraction-based control, 224, 413
- abstraction-based modeling, 218
- accumulation point, 176, 179, 202
- activation duration, 27, 235
- active damping, 449
- active index set, 152
- active suspension, 453
- activity, 15
- activity function, 59
- adaptive cruise control, 453
- adjoint pair, 80
- affine dynamics, 36
- agent, 473
 - autonomous a., 474
- aggregation, 414
- air traffic control, 276
- air traffic management, 250
- airpath control, 454
- algebraic loop, 363
- algebraic optimization, 411
- algebraic procedure, 104
- AMPL, 299, 354
- analysis, 130
 - controllability a., 52, 166
 - observability a., 52
 - reachability a., 64, 249, 264, 299, 308, 312
 - stability a., 52, 72, 121, 299
- anti-lock braking system, 441
- anti-windup, 391, 406
- application
 - air traffic control, 276
 - boost converter, 384
 - DC-DC converter, 379
 - Diesel engine, 221
 - electricity distribution, 393
 - Lake Mead, 287, 295
 - mining ventilation, 495
 - multiproduct batch plant, 419
 - power network, 393
 - solar air conditioning system, 502
- approximation, 458
 - discrete-time a., 399
 - robust affine a., 386
- architecture-specific format, 321, 324
- ASCET, 444
- asynchronous communication, 442
- automatic gearbox, 22
- automatic voltage regulator, 396
- automaton
 - differential a., 55
 - cyclic linear a., 236
 - deterministic a., 178
 - discrete hybrid a., 300
 - finite a., 228
 - gain a., 72
 - hybrid a., 59

- interchange a., 365
 - stochastic a., 213, 264
 - stopwatch a., 64
 - timed a., 40, 368
- AUTOSTAR initiative, 441
- auxiliary variables, 300
- average model, 440
- average spectral radius, 133
- AVR, *see* automatic voltage regulator

- BARON, 436
- barrier certificate, 274, 275
- BasIP, 55, 329, 346, 358
- batch plant, 419
- Bayesian procedure, 102, 104
- BDC, *see* bottom dead center
- behavior, 225
 - behavioral framework, 224
 - chaotic b., 203
 - complete b., 226
 - Zeno b., 45
- behavioral relation, 219
- bisimulation, 62, 368
 - timed b., 64
- block diagram, 329, 444
- Bohl function, 162
- Bohl-type input, 162
- Boolean optimization, 304
- Boolean variable, 300
- bottle filling system, 370
- bottom dead center, 461
- bottom-up design, 417
- bounded-error procedure, 103, 105
- branch-and-bound search, 433
- branch-and-bound technique, 429
- Brockett's model, 55
- buffer, 159
- bumpless transfer, 25

- CAPE-OPEN initiative, 327
- Carathéodory solution, 51, 161, 181
- cardinality, 207
 - minimal c., 213
- causal, 416
- causal modeling, 331
- CCM, *see* continuous conduction mode
- CDD, 304
- certainty equivalence principle, 53

- CFTOC, *see* constrained finite time-optimal controller
- chaotic behavior, 203, 208
- characteristic multiplier, 240
- charge stratification, 463
- Charon, 346
- chattering, 332
- CheckMate, 347
- Chi, *see* χ
- Church-Turing thesis, 130
- CI, *see* compression ignition
- CIF, *see* compositional interchange format
- circuit theory, 160
- CITOC, *see* constrained infinite time-optimal control
- classification, 96, 97
- clock, 63
- clock-driven, 235
- closed orbit, 238
- CLP, 304
- clustering, 101
- clustering-based procedure, 101, 104, 316
- clutch, 447
- CMTOC, *see* constrained minimum time-optimal control
- co-state variable, 388
- collision avoidance, 477
- collocation-based technique, 352
- communication, 472
- communication constraint, 197, 204
- communication network, 5, 442
- complementarity condition, 151
- complementarity system, 151, 152, 177
 - linear c. s., 151
 - switched cone c. s., 154
- complete behavior, 226
- complete model, 218, 220
- complexity, 4, 50, 130, 209, 231, 433
- complexity reduction, 307
- component, 363
- compositional interchange format, 347, 362
- compression ignition, 461
- compression ratio, 461
- compression stroke, 461
- computation tree logic, 62
- computer science, 5
- computer-automated multi-paradigm modeling, 327
- conditional equation, 332

- cone, 153
- configuration
 - nonblocking c., 479
 - safe c., 479
- conflict management, 474
- consensus problem, 473
- consistency-based diagnosis, 220
- constrained finite optimal control, 383
- constrained finite time-optimal control, 303, 306
- constrained finite time-optimal controller, 487
- constrained infinite time-optimal control, 304, 306
- constrained minimum time-optimal control, 306
- constraint, 67, 287, 434
- constraint satisfaction, 304
- continuous conduction mode, 27, 244, 379
- continuous dynamics, 7, 59
- continuous evolution, 60, 252
- continuous input, 18
- continuous state variable, 19
- continuous-to-discrete interface, 34
- continuous-valued signal, 8
- control
 - abstraction-based c., 413
 - cooperative c., 472
 - decentralized c., 472
 - distributed c., 472
 - embedded c., 4
 - finite optimal c., 383
 - finite time-optimal c., 303, 306
 - hierarchical c., 414
 - high-level c., 423
 - hybrid c., 223, 506
 - infinite time-optimal c., 304, 306
 - low-level c., 414, 423
 - model-predictive c., 52, 381, 397, 452
 - multirate c., 442
 - nonlinear model-predictive c., 427
 - optimal c., 211, 303, 418, 434
 - optimal state-feedback c., 383
 - periodic c., 243
 - PI c., 23, 427
 - receding-horizon c., 305
 - rule-based c., 450
 - spatially decentralized c., 475
 - supervisory c., 227
 - control code, 452
 - control engineering, 5
 - control mode, 59
 - control parametrization, 351
 - control software, 406
 - control switch, 59
 - control system, 442
 - Control System Toolbox*, 305
 - control validation, 443
 - controllability, 52, 166
 - controllability analysis, 52
 - controlled Markov chain, 263
 - controlled switching, 18
 - controller
 - deadbeat c., 210
 - discrete-event c., 231
 - predictive logic c., 507
 - qdb-c., 210
 - sequential c., 406
 - controller synthesis, 67
 - convex hull operator, 71
 - convex optimization, 386
 - cooperative control, 472
 - coordination, 473
 - core dynamics, 151
 - cost function, 400, 418, 423
 - cost matrix, 158
 - counter, 76
 - Cplex*, 309
 - crank angle, 461
 - crankshaft sensor management, 449
 - cruisable graph, 474
 - cruise control, 449, 453
 - current-mode control, 245
 - cut-off control, 441, 449
 - cyclic process, 27
 - cylinder pressure, 464
 - DAE, *see* differential-algebraic equation
 - DASSL, 331, 398
 - data interchange format, 320
 - DC-DC converter, 26, 379
 - DCM, *see* discontinuous conduction mode
 - dead zone, 389
 - deadbeat controller, 210
 - decentralized control, 472
 - decentralized hysteresis controller, 426
 - decidability, 62, 63
 - decision problem, 130

- delay, 472
- density, 207
- dependency graph, 363
- derivative design, 444
- DES, *see* discrete-event system
- design flow, 442
- detectability, 52
- determinism, 179
- DHA, *see* discrete hybrid automaton
- diagnosis, 213
 - consistency-based d., 220
- diagnostic algorithm, 214, 449
- diagnostic tool, 448
- difference equation, 300
- differential equation with discontinuous
 - right-hand side, 156
- differential inclusion, 41, 63, 64, 174, 176, 185
 - impulse d. i., 188
 - linear d. i., 70, 115
- differential index, 331
- differential-algebraic equation, 327, 350, 398
- diffusion process, 257
- diffusion term, 271
- direct injection stratified charge engine, 455
- discontinuous conduction mode, 28
- discontinuous differential equation, 91
- discontinuous dynamical system, 35
- discontinuous model, 93
- discrete approximation, 413
- discrete dynamics, 7, 59
- discrete evolution, 252
- discrete hybrid automaton, 300
- discrete input, 18
- discrete sensor, 18, 197
- discrete state, 19
- discrete successor, 65
- discrete-event quantized system, 215
- discrete-event simulation, 55
- discrete-event system, 223, 332
- discrete-time hybrid system, 299
- discrete-time piecewise affine system, 41, 322
- discrete-time quantized system, 215
- discrete-time stochastic hybrid system, 261, 275
- discrete-time system, 130
- discrete-to-continuous interface, 34
- discrete-valued signal, 8
- discretely controlled continuous system, 39, 90, 231
- discretization, 352
- distinguishability, 109
- distributed control, 472
- disturbance, 234
- disturbance attenuation, 241
- drift term, 271
- drive-by-wire, 454
- driveline, 445, 447
- dtPWA, *see* discrete-time piecewise affine system
- DTSHA, *see* discrete-time stochastic hybrid automaton
- dual cone, 153
- duration calculus, 55
- duty cycle, 27, 381
- dwelt time, 76, 107, 126, 235
- Dymola*, 354
- dynamical programming, 275, 386
- dynamical time scale, 416
- dynamics
 - continuous d., 7
 - discrete d., 7, 59
- EcosimPro*, 347, 365
- ECU, *see* electronic control unit
- EECI, *see* European Embedded Control Institute
- ego*, 410
- EGR, *see* exhaust gas recirculation
- ELC, *see* extended linear complementarity system
- electronic control unit, 441
- electronic throttle, 454
- embedded control, 4
- embedded controller, 7, 204, 440
- embedded logic, 427
- embedded map, 235
 - controlled e. m., 241
- embedded simulation, 410
- emission control, 449
- energy management, 378
- engaged gear identification, 447
- engine control, 440
- engine start-up, 448
- entry point, 73
- equilibrium, 72, 74, 114, 199, 233, 388

- equivalence ratio, 462, 463
- ESPRESSO*, 304
- ETAS*, 444
- European Embedded Control Institute, xv
- evaporation system, 407, 425, 430
- event, 34
 - threshold e., 144
- event function, 234
- event generator, 34, 232, 300
- event-driven sampling, 224
- event-driven switching, 235
- example
 - automatic gearbox, 22, 84
 - boost converter, 26, 153, 233, 244
 - bottle filling system, 370
 - bouncing ball, 45
 - flying ball, 173
 - Leontiev economy, 157
 - moving agent, 204
 - quantized tank system, 215
 - reset oscillator, 12
 - tank system, 10
 - thermostat, 7, 254
 - two-tank system, 17, 61, 81, 154, 354
 - user-ressource model, 158
- execution, 107, 175, 235, 252, 258, 262
 - finite e., 179
 - infinite e., 179
 - maximal e., 179
 - periodic e., 238
 - sampled e., 238
 - stable e., 239
 - synchronous e., 363
- exhaust gas recirculation, 221, 449, 454, 462
- exhaust stroke, 461
- exhaust valve control, 448
- expansion stroke, 461
- expressiveness, 327
- extended linear complementarity system, 168
- extensible markup language, 321, 364
- extensible markup language document, 323
- extremal point, 73
- fault, 397, 401, 449
- fault detection
 - f.d. of quantized system, 221
- fault diagnosis, *see* diagnosis
- fault identification
 - f.i. of quantized system, 221
- fault probability, 220
- fault tolerance, 449, 472
- feasible subsystem, 95
- feature vector, 101
- feedback linearization, 458
- Filippov solution, 51, 189
- finite automaton, 228
- finite-state automaton, 299, 335
- finite-state machine, 106, 445, 505
- finiteness property, 132
- first-principle modeling, 92
- fixpoint, 240
- flow function, 63
- flow set, 40
- flowsheet, 407
- forbidden region, 67
- forced transition, 257, 262, 275
- forward solution, 161, 189
- fuel injection, 448
- functional development, 442
- functional integration, 443
- gain, 72
- gain automaton, 72
- GAMS*, 354
- GBT*, 304
- gear-box control, 449
- Geometric Bounding Toolbox*, 304
- glcDirect*, 410
- GLPK*, 304
- gOPT*, 353
- gPROMS*, 328, 338, 353
- guard, 34, 60, 489
- guard set, 234
- HA, *see* hybrid automaton
- Hamiltonian, 79, 81
 - port control H., 388
 - port-H., 154
- HCCI, *see* homogeneous charge compression ignition
- HCCI engine, 461
- heat release, 464
- HHARX model, *see* hinging-hyperplane ARX model
- hierarchical connection, 369
- hierarchical control, 414
- hierarchical process, 508, 509

- high-level control, 423
- high-level supervisor, 414
- H_∞ -synthesis, 384
- hinging-hyperplane ARX model, 318
- HMP, *see* hybrid maximum principle
- homogeneous charge compression ignition, 461
- HW/SW components, 442
- HW/SW testing, 443
- hybrid automaton, 15, 17, 35, 59, 63, 145, 251, 407
 - network of h.a., 362
 - rectangular h.a., 63
 - regular h.a., 74
- hybrid control, 223
- hybrid decoupling constraint, 100
- hybrid decoupling polynomial, 100
- hybrid dynamical phenomenon, 9
- hybrid flow, 74
- hybrid identification, 316
- Hybrid Identification Toolbox*, 316, 320
- hybrid inclusion, 177
- hybrid jump, 275
- hybrid maximum principle, 80
- hybrid model parameter, 100
- hybrid model-predictive control, 452
- hybrid state, 59, 106
- hybrid state observer, 106
- hybrid state space, 59
- hybrid switch point, 235
- hybrid system, 4, 31
 - autonomous h. s., 8
 - continuous-time h. s., 151
 - phenomena of h. s., 9
 - structure of h. s., 33
- Hybrid System Interchange Format*, 362
- hybrid system theory, 4
- hybrid time basis, 107
- hybrid time set, 252
- hybrid time trajectory, 175
- Hybrid Toolbox*, 308, 320, 322, 459
- HyBrSim*, 348
- HYCON, xiv
- hyperplane, 72
- HYSDEL*, 299, 458
- HyTech*, 55, 286, 368
- HyVisual*, 367
- I-behavior, 226
- I/S-machine, 225
- identification, 54, 92
 - actual engaged gear i., 451
 - set-membership i., 103
- if-then rule, 144, 299
- implicit description, 173
- impulse differential inclusion, 188
- inclusion, 131
- inequality constraint, 153, 400
- initial state probability, 219
- injector, 34
- input
 - Bohl-type i., 162
 - continuous i., 8, 18
 - discrete i., 8, 18
 - quantized i., 214
- input quantizer, 199
- input/output model, 93
- input/output pair, 95
 - spurious i/o p., 218
- input/output system, 152
- intake stroke, 461
- intake throttle valve control, 441
- integer optimization problem, 507
- integral-partial-differential-algebraic equation, 327
- integration and testing flow, 442
- intensity, 269
- interchange architecture, 321
- interchange format, 41, 362
 - compositional i.f., 362
- interface, 34
- interval region, 73
- invariant, 60, 287
 - i. hypercubes, 210
 - i. property, 76
- IPDAE, *see* integral-partial-differential-algebraic equation
- Jacobian, 399
- joint spectral radius, 122, 131
- jump, 10, 287
- jump function, 61
- jump rate, 269
- jump set, 12, 40
- KRONOS, 55
- l -complete approximation, 228

- l*-completeness, 228
- labeling function, 60
- Lagrangian, 77
- language-equivalence relation, 62
- LaSalle's invariance principle, 74
- LCP, *see* linear complementarity problem
- least squares, 104
- least squares fitting, 382
- LHA, *see* linear hybrid automaton
- lifting representation, 385
- limit cycle, 203, 238
- linear classifier, 317
- linear complementarity model, 37
- linear complementarity problem, 151, 159
- linear complementarity system, 152, 168
- linear constraint, 300
- linear dynamical system, 299
- linear hybrid automaton, 62, 286, 322
- linear hybrid system, 63
- linear matrix inequality, 52, 117
- linear passive system, 160
- linear programming, 288, 304
- linear quadratic regulator, 142
- linear saturation system, 183
- linear switched system, 106, 107
- linear temporal logic, 62
- Lipschitz continuity, 257
- live-lock, 178
- liveness, 107
- LMI, *see* linear matrix inequality
- load shedding, 397
- local regression, 101
- local stability, 206
- location, 15, 59, 287
- location observability, 110
- locational optimization, 208
- logic constraint, 301
- logic controller, 406
- low complexity setup, 306
- low-level control, 414, 423
- low-level plant model, 423
- LQR, *see* linear quadratic regulator
- LTL, *see* linear temporal logic
- Lyapunov function, 114, 205, 307
 - common L.f., 116, 388
 - control L.f., 207
 - multiple L.f., 119
 - piecewise linear L.f., 120
 - poly-quadratic L.f., 123
 - quasi-quadratic L.f., 120
 - weak L.f., 121
- Lyapunov stability theory, 114
- Lyapunov's indirect method, 75
- Lyapunov-like function, 120
- magnetic actuators, 455
- Markov chain, 264, 487
- Markov parameter, 189
- Markov property, 218
 - M.p. of quantized system, 218
- mathematical programming, 152
- max-min-plus-scaling system, 169
- mean-value model, 449
- measurement aggregation, 416
- MILP, *see* mixed-integer linear programming
- minimax optimization, 304
- MINLP, *see* mixed-integer nonlinear programming
- MIQP, *see* mixed-integer quadratic programming
- mixed discrete-continuous dynamical program, 423
- mixed logical dynamical model, 37, 506
- mixed logical dynamical system, 37, 145, 168, 299, 305, 458
- mixed switching, 235
- mixed-integer linear programming, 148, 304
- mixed-integer linear sequence, 312
- mixed-integer nonlinear optimization problem, 436
- mixed-integer nonlinear programming, 351, 427
- mixed-integer programming, 96, 303, 308, 398
- mixed-integer quadratic programming, 148
- MLD, *see* mixed logical dynamical system
- MMPS, *see* max-min-plus-scaling system
- mode
 - active m., 145
- mode of operation, 152, 445
- mode selector, 145
- mode sequence, 232
- model
 - average m., 43
 - complete m., 218
 - decisive power, 41
 - discrete-event m., 196, 218
 - input/output form, 93

- modeling power, 41
- nondeterministic m., 217
- sampled-data m., 384
- model checker, 275, 286
- model checking, 54, 274
- model integration, 327
- Model Predictive Control Toolbox*, 308
- model-based design, 444
- model-predictive control, 52, 211, 353, 397, 452, 454
 - dual mode m.p.c., 211
 - explicit m.p.c., 379
- model-predictive controller, 308, 406, 507, 509
- Modelica*, 55, 283, 329, 348, 353, 357, 365
- modeling framework, 31
- modularity, 326
- modulation scheme, 493
- MPC, *see* model-predictive control
- mpQP, *see* multi-parametric quadratic programming
- MPT, *see* *Multi-Parametric Toolbox*
- MRLP, *see* multicategory robust linear programming
- MS, *see* mode selector
- multi-agent system, 474
- multi-controller scheme, 113
- multi-disciplinary design, 4
- multi-parametric programming, 303, 383
- multi-parametric quadratic programming, 308
- Multi-Parametric Toolbox*, 303, 316, 320, 322
- multi-rate automaton, 54
- multi-regime system, 157
- multicategory robust linear programming, 317
- multiMin*, 410
- multiple shooting, 351, 436
- multiple state feedback, 389
- multiple time scales, 416
- multiple-vehicle system, 478
- multiproduct plant, 419
- multirate control, 442
- MUSCOD*, 354
- natural gas, 463
- natural projection, 226
- NCS, *see* networked control system
- nearest-neighbor quantizer, 207
- needle variation, 78
- networked control system, 5, 113, 203, 472, 487
- networked system, 441
- NMPC, *see* nonlinear model-predictive control
- nominal operation, 448
- nonanticipating system, 226
- nonblocking, 178, 179
- noncausal modeling, 329
- nonconflicting behavior, 227
- nondeterminism, 216, 250
- nondeterministic hybrid system, 250
- nonlinear differential equation, 20
- nonlinear dynamics, 19, 406
- nonlinear model-predictive control, 427
- nonlinear programming, 211, 428
- nonsmooth mechanics, 6
- nonsmooth system, 42
- nonswitching time, 164
- nontriviality condition, 81
- NP, 130
- NP-complete, 131
- NP-hard, 95, 99, 130, 131
- NPSOL*, 430
- numerical simulation tool, 329
- object-oriented implementation, 324
- observability, 52, 108, 182
 - incremental o., 108, 137
- observer, 53
- observer design, 451
- obstacle, 477
- ODE, *see* ordinary differential equation
- Omola*, 329, 348
- on-board diagnosis, 449
- on/off switch, 300
- operating point, 399
- operation mode, 15, 18, 232
- optimal control, 49, 211, 303, 418, 434
- optimal state-feedback control, 383
- Optimica*, 354
- optimization, 350, 410
 - smooth constrained o., 96
- Optimization Toolbox*, 309
- optimization-based analysis using simulation, 411
- optimization-based controller, 307

- orbital stability, 239
- ordinary differential equation, 327
- oscillation, 401
- output
 - continuous o., 8
 - discrete o., 8
 - quantized o., 214
- output quantizer, 197
- over-approximation, 67, 437

- P, 130
- P-matrix, 160
- p -periodic linear system, 243
- p -periodic state feedback, 243
- packet loss, 206, 472
- parallel composition, 362
- parallel connection, 369
- particle filtering, 103
- passivity, 151, 161, 163
- passivity constraint, 454
- PCH, *see* port control Hamiltonian
- pdf, *see* probability density function
- performance, 209, 389
- periodic control, 243
- periodic solution, 384
- periodic stationary execution, 238
- periodic stationary operation, 233
- perturbation, 74
- Petri net, 55
- phase-portrait approximation, 294
- physical process, 4
- PI control, 23, 427, 433
- piecewise affine ARX model, 318
- piecewise affine autoregressive exogenous model, 93
- piecewise affine dynamics, 299
- piecewise affine feedback, 303, 452
- piecewise affine model, 453, 454
- piecewise affine system, 36, 90, 134, 137, 167, 322
 - continuous-time p.a.s., 379
 - discrete-time p.a.s., 121
- Piecewise Affine System Identification Toolbox*, 317
- piecewise linear Lyapunov function, 120
- piecewise linear system, 151, 181
- piecewise smooth system, 35
- platform, 443
- platform-based design, 443
- platform-dependent language, 321
- platform-independent format, 324
- platform-specific format, 321
- PMP, *see* Pontryagin's maximum principle
- Poisson process, 269
- polyhedral partition, 93, 308, 383
- polyhedron, 69, 303
- polynomial embedding, 99
- polynomial-time algorithm, 130
- polytope, 304
- polytope manipulation, 304
- Pontryagin's maximum principle, 78, 85
- port control Hamiltonian, 388
- port-Hamiltonian complementarity system, 154
- power conversion, 378
- power converter, *see* DC-DC converter, boost converter
- power generation, 378
- power level, 493
- power outage, 393
- power system stabilizer, 396
- power transmission, 378
- powertrain control, 454
- practical stability, 200
- practically stabilizing controller, 209
- predicate
 - convex p., 62
 - deadline p., 367
- prediction model, 398
- predictive logic controller, 507
- primary controller, 401
- priority, 367
- probabilistic safety analysis, 265
- probability density function, 102
- probability map, 274
- programming logic controller, 49
- propositional logic, 299
- PSS, *see* power system stabilizer
- Ptolemy II*, 349
- pulse width modulator, 379
- PWA, *see* piecewise affine
- PWAID, *see* *Piecewise Affine System Identification Toolbox*
- PWARX, *see* piecewise affine autoregressive exogenous model
- PWARX model, *see* piecewise affine ARX model
- PWM, *see* pulse width modulator

- qdb-controller, 210
- QoS, *see* quality of service
- QP, *see* quadratic programming
- QP solver, 309
- quadratic optimization problem, 303
- quadratic programming, 142, 304
- quality of service, 473
- quantization, 193, 197, 198
 - dense q., 203
 - input q., 208
 - output q., 198, 208
 - q. density, 206
 - q. error, 200, 208
 - q. map, 196
 - q. noise, 472, 490
 - q. threshold, 491
 - q. width, 493
 - state q., 198
- quantized behavior, 196
 - nondeterminism of the q. b., 216
- quantized input, 214
- quantized model
 - completeness of q. m., 218, 219
- quantized output, 214
- quantized state, 214
- quantized system, 196
 - discrete-event q. s., 215
 - discrete-time q. s., 215
 - q. linear s., 196
- quantized value, 214
- quantizer, 214
 - logarithmic q., 201, 207
 - nearest neighbor q., 199
 - output q., 197
 - state q., 196
- quarter car model, 454
- quasi-quadratic Lyapunov function, 120
- queue, 159
- rapid prototyping, 309
- raw data classification, 103
- rbfSolve*, 410
- re-usability, 326
- reachability, 63, 64, 230, 306
- reachability analysis, 64, 249
- reachable space, 69
- reachable state, 179
- Real Time Workshop*, 307, 309
- real-time system, 349
- real-valued variable, 300
- receding-horizon control, 304, 305
- recovery, 449
- refinement, 103, 229, 443
- refrigeration system, 426
- region, 64, 73
- region estimation, 97, 98
- region graph, 64
- region stability, 73
- regression vector, 93
- regularity, 55, 273
- relaxation, 174
- relay characteristic, 156
- relay system, 156
- reliable operation, 393
- reset, 332
- reset map, 16, 60
- residual gas, 462
- residual signal, 451
- resolution, 210
- resource allocation, 212
- resource utilization, 473
- return map, 75, 239
 - controlled r. m., 241
- RHC, *see* receding-horizon control, 305
- right-accumulation point, 46
- RLP, *see* robust linear programming
- robust controller, 304
- robust linear programming, 98
- robustness, 54, 245
- roundabout policy, 475
- rule-based control, 450
- run, 175, 288
- safety, 437, 449
 - probabilistic s., 265
- safety analysis, 67, 265, 410
- sampling
 - event-driven s., 224
 - time-driven s., 230
- sampling period, 206
- saturated linear system, 135
- saturation, 37
- scheduler, 363
- Scilab*, 349
- scope, 368
- SeDuMi*, 304
- semantics, 175
- semi-active suspension, 453

- semi-analytical approach, 410
- semi-definite programming, 304
- semicontinuous, 186
- semicontinuous function, 186
- sensor network, 473
- separation technique, 97
- sequential controller, 406
- set-membership identification, 103
- set-membership test, 303
- SHIFT*, 329, 349
- shut-down, 406
- SI, *see* spark ignition
- Siconos*, 349
- simulation, 46, 55, 444
 - block-diagram-based s., 329
- simulation tool, 326
- Simulink*, 307, 309, 444
- single-linkage clustering, 316
- single-shooting technique, 351
- slack variable, 400
- sliding behavior, 47
- sliding mode, 47, 181
- small-gain condition, 202
- small-gain theorem, 211
- smooth constrained optimization, 96
- snapshot, 73
- software engineering, 5
- solar air conditioning plant, 502
- solar energy, 393
- solution, 36, 185
 - Carathéodory s., 51
 - classical s., 50
 - Filippov s., 51
- spark ignition, 448, 461
- specification, 227, 443
- spectral radius
 - generalized s. r., 132
- SPEEDUP*, 338
- spontaneous transition, 257, 262, 275
- spurious input/output pair, 218
- stability, 43, 72, 113, 131, 165
 - asymptotic s., 114
 - exponential s., 114
 - global asymptotic s., 114
 - input-to-state s., 137
 - local s., 206
 - orbital s., 239
 - practical s., 200, 201
 - region s., 73
- stability analysis, 72, 121, 307
- stabilizability, 52, 166
- stabilization, 124, 199
- stabilizing switching law, 124
- stable system, 114
- start-up, 406, 433
- start-up performance, 389
- start-up time, 434
- state, 366
 - continuous s., 8
 - discrete s., 8
 - quantized s., 214
- state feedback, 303
- state jump, 10, 22
 - autonomous s.j., 12
 - controlled s.j., 14
- state machine, *see* automaton
- state observer, 206
- state quantizer, 196
- state space
 - partitioned s. s., 214
- state transition function, 14
- state-dependent switching, 157
- state-event detection, 363
- stationary operation, 233
- steady-state operation, 397, 407
- steepest descent, 389
- stochastic automaton, 219
- stochastic hybrid automaton, 256
- stochastic hybrid model, 55
- stochastic hybrid system, 249
- stopping condition, 367
- stopping time, 257
- stopwatch automaton, 64
- strictly passive, 165
- stroke detection, 448
- structural stability, 74
- subharmonic oscillation, 381
- supervisor, 225
 - admissible s., 227
 - generically implementable s., 227
 - least restrictive s., 227
- supervisory control, 225, 227
- supervisory control theory, 226
- support vector machine, 317
- SVM, *see* support vector machine
- switched affine autoregressive exogenous
 - model, 93
- switched circuits, 6

- switched cone complementarity system, 154
- switched linear system, 118, 425
- switched model-predictive controller, 454
- switched system, 35, 89, 137
 - autonomous s.s., 90, 112
 - controlled s.s., 89, 112
 - discrete-time s.s., 112
 - linear s.s., 106
- switching, 10, 47, 80, 131, 400
 - autonomous s., 10, 17
 - clock-driven s., 235
 - controlled s., 14, 18
 - event-driven s., 10, 235, 241
 - fast s., 124
 - mixed s., 235
 - stabilizing s., 124
 - time-driven s., 10
- switching behavior, 363
- switching condition, 80, 234
- switching diffusion system, 270
- switching frequency, 233
- switching function, 154
- switching logic, 232
- switching period, 27
- switching scheme, 27
- switching set, 10, 77, 80
- switching structure, 45
- switching surface, 47, 90
- switching system, 90
- switching time, 77, 80, 164
- synchronization, 60, 365, 427
- synthesis, 406
- synthesis flow, 442
- system
 - max-min-plus scaling s., 55
 - chaotic s., 203
 - continuous s., 43
 - discontinuous dynamical s., 35
 - discrete-event s., 43
 - discrete-time stochastic hybrid s., 275
 - hybrid s., 4
 - mixed logical dynamical s., 37
 - passive s., 165
 - piecewise smooth s., 35
 - switching diffusion s., 270
 - switching s., 90
 - timed s., 363
- System Identification Toolbox*, 305
- system integration, 441
- system specification, 442
- system testing, 443
- systems theory, 5
- target vector, 79
- target region, 434
- target set, 77
- TDC, *see* top dead center
- technological system, 4
- temporal logic, 62
- TG, *see* turbine governor
- theorem proving, 411
- thermostat, 7, 254
- throttle valve control, 448
- tight over-approximation, 294
- time scale, 378
- time-varying linear system, 131
- time-varying parameter, 128
- timed automaton, 40, 54, 63, 350, 409
- timed computation tree logic, 64
- TOMLAB*, 353, 410
- tool-specific layer, 321
- top dead center, 461
- traction control, 453
- transition function, 234
- transition intensity, 275
- transition kernel, 262
- transition probability, 264
- transition relation, 59
- transition system, 59
- transmission network, 393
- transversality condition, 81
- turbine governor, 395
- Turing machine, 134, 135
- two-layer architecture, 433
- two-level control architecture, 414
- two-level hierarchical solution, 418
- two-tank system, 17
- uncertainty, 304
- uncertainty set, 131
- undecidability, 63, 69, 130, 134
- uniform time scale, 415
- unilaterally constrained mechanical system, 182
- uniqueness, 187
- unsafe set, 264
- UPPAAL*, 55, 283, 329, 347, 349, 368
- urgency, 363, 366

Cambridge University Press

978-0-521-76505-3 - Handbook of Hybrid Systems Control: Theory, Tools, Applications

Edited by Jan Lunze and Françoise Lamnabhi-Lagarigue

Index

[More information](#)

Index 565

- urgency predicate, 367
- urgent guard semantics, 367
- usability, 327
- valve assembly, 407
- variable, 141
 - connected v., 369
- variable geometry turbine, 221, 454
- VDC, *see* vehicle dynamical control
- vector field, 59, 60
- vehicle dynamical control, 441
- vehicle dynamics, 453
- verification, 62, 264, 303, 406
- VGT, 449, 454
- voltage instability, 393, 397
- voltage regulation, 381, 393, 396, 397
- VTG, *see* variable geometry turbine
- Wardrop principle, 158
- weak Lyapunov function, 121
- well-defined solution, 173
- well-formed expression, 175
- well-posedness, 36, 46, 173, 178
 - global w., 179
 - initial w., 178
 - local w., 179
- Wiener process, 256
- wind energy, 393
- wireless communication, 473
- worst-case analysis, 250
- XML, *see* extensible markup language
- XML Toolbox*, 321
- YALMIP*, 302
- Zeno
 - left-Zeno free, 164
 - right-Zeno free, 164
 - Zeno free, 164
- ZENO, 45
- Zeno behavior, 45, 180, 189, 332
- Zeno phenomenon, 191
- zero crossing, 46