

Index

a

absorption process 218, 299, 320
 acetic anhydride 159
 acetylene 330, 331
 air-SO₂ mixture 274
 α-methyl styrene 322, 323
 ammonia
 absorption 276
 solubility 272
 angiotensin-I converting enzyme (ACE)
 349
 arginine ethyl ester (AEE) 341
 Arrhenius equation 239
 Arrhenius law 118, 242
 Arrhenius law for kinetic constants
 57–58
 Arrhenius-type 294
 average reaction rate 231
Azotobacter vinelandii 364

b

batch electric fryer 91
 batch fermentation reactor 375
 batch reactor 57, 68
 fed 381
 stirred 351
 temperature 118
 bed porosity 60, 269, 281
 benzene 188, 256
 benzoic acid 318
 β-glucosidase 345
 biochemical reaction 379
 biological denitrification 355

biomass 358, 360, 365, 371, 374, 376,
 378, 380

bioreactor 358, 365, 369, 371

bubble dispersions 317

c

Calderbank correlation 330, 331
 carbonaceous granules 328
 carbon dioxide (CO₂) 294, 303, 319, 320
 carbon tetrachloride 311
 catalyst bed 269, 322
 catalyst charge 284
 catalyst particle 167, 221, 241, 249, 254,
 255, 269, 270, 281, 283, 286
 catalyst pellets 234, 237, 257, 262, 324
 catalyst weight 221, 256, 280
 catalytic reaction 228, 258, 262, 267
 catalytic reactor 246
 fixed bed 294
 liquid-phase 289
 packed bed 253
 cell concentration 363–365, 368, 381
 chemical equilibrium 260
 chemical reaction rate 218, 247
 Chemical Reactor Engineering 27
 convolution and deconvolution of
 signals in 141–155
 partial differential equations in
 157–212
 chemostat 358, 364, 367, 368, 370, 371,
 376, 378
 chlorinated compounds 311, 315
 chlorobenzene 188, 311

- chloroform 311
 closed-closed dispersion model 24
 closed-closed recipient 4, 9, 100, 165
 constant velocity 197
 continuous bioreactor 369
 continuous-flow reactor system 291
 continuous fluidized bed reactor 219
 continuous reactor 20, 24, 232
 in liquid phase 66
 mean residence time 63, 64
 space time 74
 stirred tank reactors 73
 continuous stirred tank bioreactor (CSTB)
 358–360, 364
 continuous stirred tank reactor (CSTR)
 21, 25, 60, 291, 360, 379
 blades 97
 commercial installation 84
 first-order irreversible reaction 86
 first, second, and third tanks 79
 in liquid phase 87
 non-steady state working in 159
 organic oxide and calcium carbonate
 116
 rate constant 104, 105
 reactor system 83
 space time and feed conversion 78, 79
 tubular reactor 99
 unsteady state working in 158
 volumes of 81, 83
 convolution operation 141
 cumene cracking reaction 250
 cyclohexanone 33
 cylindrical catalytic converter 225
- d**
- Danckwerts boundary conditions 164
 deconvoluted signal 146
 deconvolution 143–144, 153
 D-glyceraldehyde 3-phosphate 343
 dihydroxyacetone phosphate 343
 dimensionless numbers 120, 216
 diol hydrogenation 327
 Dirac delta function 136, 143
- dispersed plug flow model 320
 dispersion model 4, 5, 9, 13, 22–24, 34,
 45, 47, 55, 56, 58–61, 64, 88, 94,
 98–100, 178
 dissolved oxygen concentration 318
- e**
- Eadie-Hofstee linealization 346
 energy balance 192, 197, 205, 208
 enzymatic hydrolysis 341, 344
 enzymatic reactions 308, 337, 350
 enzyme kinetics 337
 equilibrium constants 351
 equilibrium relationship 332
Escherichia coli growth 362
 in glucose 372, 373
 ethanol
 conversion 324
 production 353
 ethyl acetate 242
 ethylbenzene 166, 249, 260–262
 explicit finite difference method 209
 external diffusion, rate of 216
 external temperature gradient 257
- f**
- fatty alcohols 291
 fatty esters 291
 fed-batch bioreactor 359–360
 fed-batch reactor 381
 fed-batch startup 183
 fermentation process 364
 fermenter 308, 360, 371, 377
 stirred tank 370–371
 tubular 359
 fiber optic technique 44
 Fick's law 164, 167, 222
 Fick's second law 161
 finite differences method (FDM) 157
 first derivative 157
 second derivative 157
 stability of 157–158
 first-order irreversible liquid phase
 reaction 84, 92, 97

- first-order irreversible reaction 28, 81, 86, 94, 96, 101, 102
 first order kinetics 56, 57, 97, 159, 164, 169, 170, 172, 173, 189, 217, 247, 253, 256, 281, 288, 327
 first-order reaction 220, 253
 dispersed plug flow 73
 PFR 70
 reactor conversion 58
 tubular reactor 69
 fixed bed catalytic reactor 294
 fixed-bed reactor 244, 262, 263, 279, 280, 284, 288, 341
 fluid-fluid reaction 299–301
 fluidized bed 219, 254, 323
 Fourier's law 192, 194
 fructose 350
- g**
- gas distributor plate 330
 gas-liquid dispersion 320
 gas-liquid reaction 301, 317
 gas phase catalytic reaction 267
 gas-phase dispersion coefficient 321
 gas-phase reaction 221, 237, 288
 gelatinization process of cornmeal 111, 112
 glucose 350
 feed flow 373
 glyceraldehyde 3-phosphate 343
 glycerol 363, 364
- h**
- Hatta modulus 317, 320
 heat balance 166, 192–194, 196–198
 heat conduction 191
 heat transfer coefficient 166, 257
 Henry's constant 304, 330
 heterogeneous irreversible reaction 226
 heterogeneous reaction 304
 heterogeneous systems, rate in 215–216
 hippuric acid (HA) 349
 hippuryl-L-histidyl-L-leucine (HHL) 349
 homopolymer 185
- hydrogen
 solubility 326
 vs. sulfur hydrocarbons 306
 hydrolysis 159, 341, 344, 345, 348–350
 hydrostatic pressure effect 304
- i**
- ideal CSTR 25–27, 76, 78, 79, 83, 84, 86, 87, 93, 94, 96, 97, 99, 104
 ideal exchange reactor model 134
 ideal isothermal batch reactor with a constant volume 74
 ideal PFR 25–27, 31, 69, 70, 74, 76, 83, 95, 96, 99, 102, 103, 269, 270
 ideal reactors 36
 mass balance 57
 RTD 4
 transfer function in 124
 working in unsteady state 158
 internal diffusion 221, 234, 237, 254, 313, 316
 internal diffusion effect 217–218
 intrinsic pseudo-homogeneous rate 283, 284
 intrinsic rate 223, 262, 265
 intrinsic rate constant 227, 228, 256, 262
 intrinsic reaction constants 230
 intrinsic reaction rate 267
 inverse Laplace transform 136
 irreversible unimolecular reaction 345
 isothermal fixed-bed reactor 262
 isothermal liquid 220
 isothermal tubular reactor 267
- k**
- kinetic constant 57–58, 79, 88, 94, 217, 220, 223, 232, 242, 246, 247, 268, 285, 291
 Knudsen diffusivity 224–226, 249
- l**
- lactine molecules 353
 Laplace transform 37, 123, 126–128, 131, 136, 137

L-benzoyl arginine 348
 Lineweaver-Burk linearization 345
 liquid-phase catalytic reaction 262
 liquid-phase catalytic reactor 289

m

maleic anhydride (MA) 290
 mass balance 25, 163, 313
 in ideal reactors 57
 of substrate 359
 mass transfer 161
 coefficients 240, 258, 278, 289, 308
 rate 278
 material balance 33, 313, 314, 374, 380, 381
 Matlab 37, 148, 151, 154, 171, 190, 204, 207, 212, 382
 matrix convolution 142
 mean residence time 3, 21, 33, 39–41, 43, 45, 52, 63, 76, 80, 86, 87, 92, 94, 112, 127, 129, 321
 methanol 294, 361
 Methylomonas 361
 Michaelis constant 338, 343, 351
 Michaelis-Menten kinetics 337, 341, 343–345, 352–354
 Michaelis-Menten reaction 349
 microbial growth rate 371, 377
 milk protein 353
 mole balance 158, 159, 164, 173, 302, 331, 333, 334
 molecular weights 223–226, 237, 259, 260, 275
 mole fractions 261
 mole of reaction 60, 66, 232, 265
 Monod kinetics 357, 370, 373, 375, 377
 Mordenite zeolite 248
 multitubular reactor 259, 260

n

n-butane 290
 nitrate concentration 355
 nitrate, mass balance of 355–356
 nitrogen porosimetry 246

NO concentration 328, 329
 nomenclature 118, 126, 129, 131, 135
 non-ideal reactor 55–121, 125, 134, 136
 non-ideal tank reactor 145
 nonlinear relationship 251, 254
 non-steady state approximation 205
 n-th order kinetics 55
 nucleophile compound (NaNH_2) 315

o

Octave 151
 o-methylbenzoic acid 317
 one-meter-long reactor 177
 open-open recipient 4, 9, 165
 ordinary differential equation (ODE) 170, 175, 201, 209, 292
 oxidize o-Xylene 317
 oxygen concentration 318, 325
 oxygen consumption rate 318
 o-Xylene concentration 318

p

packed bed catalytic reactor 253
 packed bed reactor 223, 258, 264
 palladium 322
 partial pressure 223, 245, 256–259, 262, 295, 303, 307, 313, 318–320
 partial pressure drop 257
 Peclet number 6, 13, 22, 45
 phenol 33
 photoreactor 71
Pichia pastoris 363
 plug flow model 73, 320
 plug flow reactor (PFR) 16, 25, 60, 268–271, 281, 286, 341, 355
 DTR 105
 dynamic regime working in 159
 with first-order reaction 70
 with residence time 65
 space time 76
 unsteady state working in 158
 p-nitroanilide hydrochloride 348
 p-nitrophenyl- β -D-glucopyranoside 345
 porous-sphere model 271

- potassium permanganate 6
 Prandtl number 257
 protein production 353
 pseudo-first order reaction 321
 pseudo-homogeneous rate 283, 284
Pseudomonas sp. 368, 370
- q**
 quasi-steady state assumption (QSSA)
 338–340, 351
- r**
 rate constants 28, 62, 232, 234, 287, 318
 continuous stirred tank reactor 104,
 105
 intrinsic 227, 228, 256, 262
 reactant concentration 163, 223, 283
 reaction order (n) 254
 reaction rate 215
 of the monomer 85
 reaction system 35, 42, 85, 87, 232
 reactive gas 167
 reactor/catalyst system 253
 reactor conversion, first-order reaction
 58
 recycle reactor 279, 282, 283
 residence time 62, 317, 355
 distribution 3
 mean 3, 21, 33, 39–41, 43, 45, 52, 63,
 76, 80, 86, 87, 92, 94, 112, 127, 129,
 321
 plug flow reactor 65
 residence time distribution (RTD) 119
 of CSTR 21
 in ideal reactors 4
 reversible reactions 217, 284, 285
 Reynolds number 220, 257, 289
 RFP 36, 129, 130, 133
 Rhodamine-B dye 44
 room temperature 118, 205, 344
 rotating drum absorber 303
- s**
 salt concentration 31
 second order approximation 169
 second order aqueous reaction 107, 109
 second-order gas phase reaction 237
 second-order irreversible liquid phase
 reaction 95
 segregated flow model 112, 115, 119
 segregation model 56, 58, 68
 non-ideal flow 70
 Sherwood number 258, 288
 slab geometry 221
 slurry bed reactor 324, 326, 327
 slurry configuration 322
 slurry reactor 291, 293, 322
 SO₂ concentration 313
 SO₂ elimination 247
 solid-liquid interphase 322
 space time 24, 76, 78, 79, 90, 94,
 250, 254
 spherical catalyst 228, 230, 236, 241,
 249, 255, 262, 269, 281, 284
 stirred-batch reactor 351
 stirred tank fermenter 364, 370, 372,
 373, 377
 stirred tank reactor 58, 73, 88, 91, 101,
 107–109, 125, 134, 322
 stoichiometric coefficients 232, 295
 stoichiometry 117, 228, 265, 292, 305,
 326
 styrene manufacturing 260, 261, 322,
 323
 sucrose 344, 350
 sulfur hydrocarbons 306
 superficial velocity 61, 74, 289, 320
- t**
 tailing 47
 tank fills, temperature changes 200
 tanks in series (TIS) model 4, 9, 55, 58,
 67
 tank slurry reactor 322
 Thiele modulus 221, 222, 235, 246–249,
 256, 262–264, 287, 305, 307, 322,
 325, 328, 330, 352
 Thodos equation 258

- Thoenes-Kramers relation 329
 - tortuosity 225, 255
 - tracer concentration 30, 35, 36, 103, 124, 128, 131, 134
 - tracer input signal 147
 - tracer pulse 35, 41, 171
 - tracer step input 39
 - transfer function in chemical reactor
 - design 123–137
 - trial-and-error method 236, 238, 251
 - triose phosphate isomerase 343
 - triphasic catalytic process 311
 - true rate of reaction 236
 - tubular biochemical reactor 374
 - tubular fermenter 359
 - tubular reactor 174, 188, 227
 - CSTR 99
 - dispersion coefficient 98
 - fraction of flow 108
 - kinetics 120, 121
 - Tylosin 360, 361
- V**
- viscous dissipation 192
 - VPO catalyst 290
- W**
- wastewaters 355
 - Weisz modulus 254, 255, 286
- Y**
- yeast cells 364
 - yeast strain 365
- Z**
- zero-order kinetics 101, 221

