INDEX

acceleration, 211
accelerometer, 97
active damping, 285
adaptive control, 3, 318
adaptive generalized predictive control, 325
added lobe, 171
alternating current (ac), 258
angle
  approach, 33
  clearance or relief angle, 13
chip flow, 21
friction, 7
helix, 41
immersion, 151
normal rake, 52
pitch, 39, 151
rake, 7
shear, 6, 9, 19
side rake, 28
taper, 52
inclination, 5
angular, 115
APT, 206
arc length, 243
armature, 258
automatically programmed tools (APT), 201, 206
autospectrum, 95
average friction coefficient, 11, 13
axial deflections, 172
back electromotor, 258
backlash, 257
ball lead screw, 251
bilinear approximation, 102
Bode diagram, 290
borderline stability, 128
boring bar, 70
CAD/CAM, 201, 206
cascaded control, 288
causality rules, 304
change of variable, 153
characteristic equation, 77, 100, 128, 141, 156
chatter, 2
detection, 333
drilling, 172, 176
frequency, 129
milling, 149
orthogonal, 126
process damping, 142
threshold, 334
turning, 139
chatter frequency, 158
chisel edge, 47
CL file, 211
closed-loop transfer function, 265
CNC, 211, 250, 313
CNC design, 2
CNC executive, 193
coherence function, 96
computer aided design/computer aided manufacturing, 201, see CAD/CAM
Computer Aided Manufacturing-International, 206, see CAM-I
computer numerically controlled, 1, 191, see CNC
coupling, 116
critical depth of cut, 158
critically stable, 133
cross FRF, 83, 140
cross-power spectrum, 95
cross-talk, 176
cutter location (CL) files, 209
cutting constants, 16
cutting force
  prediction, 25
cutting lip, 48
deceleration, 211
delay differential equation, 127
delayed differential equation, 178
differential elements, 52
friction, 1
digital filter, 264
friction power, 11
digital to analog (D/A) Converter, 264, also see
friction torque, 254
D/A
frictional loss, 252
dimensional errors in milling, 73
global nonlinear optimization, 113
dimensional form error, 68
 guideway, 252
Diophantine equation, 323
harmonics of tooth passing, 158
direct current (dc), 251
hydraulic actuators, 293
direct receptance, 117
hydraulic press, 295
directive factors, 141, 153, 176
hydraulic system, 295
directional matrix, 162
identification, 353
directional coefficient matrix, 154
immersion, 38
discrete lumped masses, 98
immersion radial, 160
discrete position control, 265
indentation, 48
discrete time, 266
inner and outer waves, 129
discrete time intervals, 353
integration limits, 45
discrete transfer function of milling, 319
identification, 353
drives, 66
immersion
dynamic chip thickness, 127
impact hammer, 97
dynamic drilling, 172
intelligent machining, 313
dynamic loads, 254
intelligent pocketing, 334
dynamic milling force, 162
interpolation, 212
edge coefficients, 16
circular, 234
eigenvalue, 157, 181
tangential, 6, 15
eigenvalue matrix, 167
threshold, 53
eigenvalue solution, 170
transient, 230
eigenvector, 90, 102
tangential, 230
electrical drive, 257
interpolation steps, 223, 224
electrohydraulic CNC, 293
Constant Displacement, 212
encoder, 256
time, 213
equation of motion, 91
jerk, 211
experimental modal analysis, 98
knots, 205
fixed cycles, 199
Laplace transform, 341, 343
Floquet, 185
lateral, 158
following error, 267
lateral flexibility, 285
force
lead–lag compensator, 280
feed, 15
least squares, 112, 355
resultant, 15
least-squares estimation, 353
shear, 7, 15
linear systems, 101
thrust, 53
local displacements, 92
forces
linear, 230
analytical modeling, 43
interpolation, 212
differential, 44
interpolation steps, 223, 224
feed, 39
Constant Displacement, 212
ploughing, 13
Lyapunov function, 283
turning, 31
M functions, 196
forgetting factor, 321
maximum shear stress principle, 18
Fourier
minimum energy principle, 23
analyzer, 93
mechanics
coefficients, 81
drilling, 47
series, 81
helical end mills, 41
spectrum, 82
milling, 35
turning, 27
mechanistic, 15
Merchant, 18
FRF-frequency response function, 79
FRF-relative, 90
Merrit, 127
milling
  cutting constants, 46
down, 37
dynamic, 149
face, 37
form errors, 71
power, 40
torque, 39
up, 37
milling dynamics, 182
minimum energy principle, 18
miscellaneous functions, 196
modal
  coordinates, 89
damping matrix, 89
damping ratio, 102
displacement, 88
displacement vector, 92
frequency range, 111
mass, 88
matrix, 88
parameters identification, 109
stiffness, 88
testing, 92, 97
transfer function, 90
transformation, 89
modal analysis, 2, 85
mode shapes, 88, 102
multi-degree-of-freedom (MDOF), 85
multi-frequency, 169
natural frequency, 76
NC, 250
NC block, 193
NC part programming, 211
NC program, 193
NC words, 194
negative gradient, 114
negative-positive, 37
noise, 95
nonlinear cutting constant, 127
normalized eigenvector, 170
normalized mode shape, 103
nose radius, 142
numerically controlled, 191, see NC
Nyquist frequency, 93
oblique cutting, 1, 19, 23
open-loop transfer function, 267
orthogonal cutting, 4
oriented FRP, 83
orthogonal cutting, 178
overcut, 71
oxidation, 57
partial fraction example, 349
partial fraction expansion, 347
peak current, 251
peak torque, 251
periodic functions, 154
permanent magnet dc motor, 258
phase angle, 129
phase shift, 142, 157
plane strain, 4
primary shear zone, 5
plane
  normal, 20
  velocity, 20
PLC, 192
point-to-point (PTP), 207
pole-placement control algorithm, 321
pole-placement controller, 303
position loop, 263
power, 33
power amplifier, 260
prediction output horizons, 327
process damping, 2, 135
  flank wear, 145
process damping coefficient, 139
proportional damping, 88
quadrature sensing, 257
rake face–chip interface, 12
real part, 80
receptance, 79
receptance coupling, 115
reconstruction of reference trajectory, 227
recursive computation, 328
recursive parameter estimation, 355
regenerative chip, 144
residue, 99
rotation of objects, 203
rotational, 117
single degree of freedom (SDOF), 75
secondary deformation zone, 5
sensor-assisted, 313
servoamplifiers, 2
shaker, 97
shear plane temperature, 8
shear power, 8
shear strain, 10
shear strain rate, 10
sliding friction, 5
sliding mode controller, 281
sliding surface, 282
spindle dynamics, 118
spline
  cubic, 204
  quintic, 239
segment, 204
spool valve, 299
stability
  analysis, 147
  chart, 130
dimensionless, 132
INDEX

stability (cont.)
discerte time domain, 182
drilling, 172
lobes, 132
low immersion milling, 170
multi-frequency, 160
Nyquist, 138
orthogonal, 126
pockets, 149
semi discrete, 178
zero order solution, 154
Stabler, 31
state matrix, 270
state space model, 268
static deflection, 71
static deformations, 1
static flexibility, 80
static loads, 252
steady-state error, 268
step response, 272
sticking, 5
strain rate, 10
substructure, 115
surface
drive, 208
part, 208
surface
check, 208
tachometer, 256
tertiary deformation zone, 12
tertiary zone, 5
tool–chip interface temperature, 12
thrust bearing, 253
time constant, 260
time-varying cutting, 319
time-varying directional matrix, 175, 185
Tlusty, 127
Tobias, 127
tool breakage, 61
tool life, 60
tool nose radius, 29
tool wear, 54
tool-holder, 119
tooth passing frequency, 167
torque, 33, 53
disturbance, 259
torsional, 158
torsional flexibility, 285
trajectory function
matrix, 100
MDOF, 100
structures, 76
transition matrix, 181
translation of objects, 203
translational, 115
transmission gain, 289
turning, form errors, 68
Tustin's bilinear, 267
undamped, 87
undercut, 71
up–down counter, 263
vectors, 201
velocity profile
acceleration-limited, 216
trapezoidal, 213
velocity hodograph, 8
velocity profile
jerk limited, 220
velocity-dependent, 137
vibration
forced, 75, 76, 79
free, 75
transient, 76
waves, 129
wavelength, 137
wavy surface, 138
wear
abrasion, 56
adhesion, 56
crater, 57
diffusion, 56
flank, 55, 57
window
box, 98
exponentially decaying, 98
yield shear stress, 1
z transform, 341, 343
zero-order hold, 264, also see ZOH
ZOH, 342