## Index

A	
Algebraic Lyapunov Equation	pp.80 - 82
Arrow Matrix	pp.150 - 32 $pp.150 - 154$
Asymptotically Stable	pp.7,61 - 62,67 - 69,75
Attractiveness	pp.61, 99
B	pp.01,00
Bendixson's Theorem	pp.25 - 29
Bifurcation	pp.12 - 13
Bifurcation (Fold)	pp.12 - 13 $pp.12 - 13,57$
Bifurcation (Transcritical)	pp.12 - 15, 51 $pp.12 - 15$
Bifurcation Diagram	$pp.12  ext{ 13}$ $pp.12, 15 - 17$
C	pp.12, 10 11
Carrying Capacity	p.9
Center Manifold Theory	pp.39 - 45
Centers (Equilibrium Point)	pp.22, 26
Characteristic Equation	p.34
Class K (Comparison Functions)	pp.93 - 97, 102 - 112
Class K L (Comparison Functions)	pp.93 - 97, 102 - 112
Class $K_{\infty}$ (Comparison Functions)	pp.93 - 96,105
Comparison Function	pp.93 - 96,102 - 103
Continuity w.r.t. Initial Conditions	pp.53 - 55
Continuity w.r.t. Parameters	pp.54 - 55
Continuously Differentiable	pp.48 - 52
Control Lyapunov Function	pp.167,179 - 180
Controllability Gramian	p.80
Coordinate Transformation Matrix	pp.18, 20 - 41
D	FF ()
Diagonalization	p.79
Differentiable	pp.51 - 52
Differential Lyapunov Equation	pp.121 - 122, 128
Divergence	pp.25 - 29
E	11
Equilibrium Point	pp.3-4
Estimation of Constant Parameters	pp.130 - 149
Existence And Uniqueness Theorem	pp.46 - 52,91
Exponential Stability	pp.103 - 104, 107, 116 - 123, 168
F	
Finite Escape Time	pp.9 - 10
Focus Node	pp.22, 33
Fold Bifurcation	pp.12 - 13,57
G	
Geometric Series	p.92
Globally Asymptotically Stable	pp.62, 67
Green's Theorem	pp.25 - 27
H	

TI - C 1 TI	22 24
Hartman Grobman Theorem	pp.23 - 24
Homeomorphic	p.23
Hopf Bifurcation	pp.35 - 38
Huber Function	p.71
Hurwitz Matrix	pp.81 - 82
Hyperbolic Equilibrium Point	pp.22 - 24
I	
Index Theory	p.35
Infinity Norm	p.61
Integrator Backstepping	pp.165 - 178
Invariant Manifold	pp.42 - 45
Invariant Set	pp.74 - 77
J	11
Jacobian	pp.56 - 58
L	PP.00
L1 Norm	p.61
L2 Norm	p.61
	p.01 $pp.74 - 77,85 - 87$
La Salle's Invariance Principle	
Level Sets	pp.66 - 69
Lie Derivative	pp.179 - 184
Limit Cycle	pp.10 - 12,33 - 38
Linearization at a Fixed Point	pp.5 - 8, 23 - 24, 88
Lipschitz Continuous Function	pp.49 - 55,91
Locally Asymptotically Stable	pp.61 - 62,67 - 69
Logistic Equation	p.9
Lorenz Attractor	p.12
Lyapunov Functions	pp.65 - 87
Lyapunov Stability	pp.59 - 69,106 - 121
M	
Manifolds, $C^k$ Differentiable	pp.48 - 52
Metzler Matrix	p.31
Model Reference Adaptive Control	pp.154 - 165
N	
Negative Semidefinite Function	pp.67,74-162
Nesterov Acceleration	p.98
Node	pp.21, 33
0	pp.21, 30
Observability	pp.86 - 87, 127, 130, 138 - 141
Observability Gramian	pp.80, 129
Observer Based Controller	pp.135 - 136
P	61
P Norm	p.61
Pendulum	pp.7 - 8,63 - 64,72 - 77
Periodic Orbits	pp.25 - 34
Phase Portrait	pp.5, 17 - 19
Pitchfork Bifurcation	pp.12, 15 - 17
Poincare Bendixson Criterion	pp.32 - 34

Positive Definite Function	pp.65 - 66
Positive Definite Matrix	pp.78 - 79
Positive Invariant Set	pp.21, 29 - 34, 69
Positive System	p.31
Predator/prey Model	pp.30 - 31
R	
Radially Unbounded	pp.67 - 68,105 - 107
Reference Signal Tracking	pp.177 - 178, 183
Region of Attraction	pp.15, 92 - 93
Relative Degree	pp.181 - 184
Routh Hurwitz Criterion	pp.34, 83
S	FF - /
Saddle Node	pp.19 - 21
Sector Bounded Nonlinearities	p.72
Sensitivity Function	pp.55 - 58
Sink Node	pp.19, 21
Sontag's Formula	p.180
Source Node	pp.19, 21
Stability	pp.5, 98 - 103
Stability Via Linearization	pp.88 - 90
Stable	p.5
State Transition Matrix	pp.105 - 106, 121 - 123
Subcritical Hopf Bifurcation	pp.37 - 38
Subcritical Pitchfork Bifurcation	p.17
Supercritical Hopf Bifurcation	pp.35 - 37
Supercritical Pitchfork Bifurcation	pp.15 - 16
Symmetric Matrix	p.78
T	
Taylor Series Expansion	pp.6, 39 - 40, 44 - 45
Transcritical Bifurcation	pp.12 - 15
U	
Uniform Observability	pp.129 - 130, 138 - 143
Uniformly Asymptotically Stable	pp.100 - 104, 107 - 116
Uniformly Exponentially Stable	pp.103 - 104, 107, 116 - 123
Uniformly Stable	pp.100 - 102, 104, 107 - 114
Unitary Diagonal Coordinate Transformation	p.79
V	
Van Der Pol Oscillator	pp.11 - 12
Z	
Zero Dynamics	pp.181 - 182