

# Index

## A

- Algebraic Lyapunov Equation *pp.*80 – 82
- Asymptotically Stable *pp.*7, 61 – 62, 67 – 69, 75
- Attractiveness *pp.*61, 99

## B

- Bendixson's Theorem *pp.*25 – 29
- Bifurcation *pp.*12 – 13
- Bifurcation (Fold) *pp.*12 – 13, 57
- Bifurcation (Transcritical) *pp.*12 – 15
- Bifurcation Diagram *pp.*12, 15 – 17

## C

- 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
- Controllability Gramian *p.*80
- Coordinate Transformation Matrix *pp.*18, 20 – 41

## D

- Diagonalization *p.*79
- Differentiable *pp.*51 – 52
- Differential Lyapunov Equation *pp.*121 – 122, 128
- Divergence *pp.*25 – 29

## E

- Equilibrium Point *pp.*3 – 4
- Estimation of Constant Parameters *pp.*130 – 132
- Existence And Uniqueness Theorem *pp.*46 – 52, 91

## 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

- Hartman Grobman Theorem *pp.*23 – 24
- Homeomorphic *p.*23
- Hopf Bifurcation *pp.*35 – 38

Huber Function	<i>p.71</i>
Hurwitz Matrix	<i>pp.81 – 82</i>
Hyperbolic Equilibrium Point	<i>pp.22 – 24</i>
<i>I</i>	
Index Theory	<i>p.35</i>
Infinity Norm	<i>p.61</i>
Invariant Manifold	<i>pp.42 – 45</i>
Invariant Set	<i>pp.74 – 77</i>
<i>J</i>	
Jacobian	<i>pp.56 – 58</i>
<i>L</i>	
L1 Norm	<i>p.61</i>
L2 Norm	<i>p.61</i>
La Salle's Invariance Principle	<i>pp.74 – 77, 85 – 87</i>
Level Sets	<i>pp.66 – 69</i>
Limit Cycle	<i>pp.10 – 12, 33 – 38</i>
Linearization at a Fixed Point	<i>pp.5 – 8, 23 – 24, 88</i>
Lipschitz Continuous Function	<i>pp.49 – 55, 91</i>
Locally Asymptotically Stable	<i>pp.61 – 62, 67 – 69</i>
Logistic Equation	<i>p.9</i>
Lorenz Attractor	<i>p.12</i>
Lyapunov Functions	<i>pp.65 – 87</i>
Lyapunov Stability	<i>pp.59 – 69, 106 – 121</i>
<i>M</i>	
Manifolds, $C^k$ Differentiable	<i>pp.48 – 52</i>
Metzler Matrix	<i>p.31</i>
<i>N</i>	
Negative Semidefinite Function	<i>pp.67, 74</i>
Nesterov Acceleration	<i>p.98</i>
Node	<i>pp.21, 33</i>
<i>O</i>	
Observability	<i>pp.86 – 87, 127, 130</i>
Observability Gramian	<i>pp.80, 129</i>
<i>P</i>	
P Norm	<i>p.61</i>
Pendulum	<i>pp.7 – 8, 63 – 64, 72 – 77</i>
Periodic Orbits	<i>pp.25 – 34</i>
Phase Portrait	<i>pp.5, 17 – 19</i>
Pitchfork Bifurcation	<i>pp.12, 15 – 17</i>
Poincare Bendixson Criterion	<i>pp.32 – 34</i>
Positive Definite Function	<i>pp.65 – 66</i>
Positive Definite Matrix	<i>pp.78 – 79</i>
Positive Invariant Set	<i>pp.21, 29 – 34, 69</i>
Positive System	<i>p.31</i>
Predator/prey Model	<i>pp.30 – 31</i>
<i>R</i>	
Radially Unbounded	<i>pp.67 – 68, 105 – 107</i>

Region of Attraction	<i>pp.</i> 15, 92 – 93
Routh Hurwitz Criterion	<i>pp.</i> 34, 83
<i>S</i>	
Saddle Node	<i>pp.</i> 19 – 21
Sector Bounded Nonlinearities	<i>p.</i> 72
Sensitivity Function	<i>pp.</i> 55 – 58
Sink Node	<i>pp.</i> 19, 21
Source Node	<i>pp.</i> 19, 21
Stability	<i>pp.</i> 5, 98 – 103
Stability Via Linearization	<i>pp.</i> 88 – 90
Stable	<i>p.</i> 5
State Transition Matrix	<i>pp.</i> 105 – 106, 121 – 123
Subcritical Hopf Bifurcation	<i>pp.</i> 37 – 38
Subcritical Pitchfork Bifurcation	<i>p.</i> 17
Supercritical Hopf Bifurcation	<i>pp.</i> 35 – 37
Supercritical Pitchfork Bifurcation	<i>pp.</i> 15 – 16
Symmetric Matrix	<i>p.</i> 78
<i>T</i>	
Taylor Series Expansion	<i>pp.</i> 6, 39 – 40, 44 – 45
Transcritical Bifurcation	<i>pp.</i> 12 – 15
<i>U</i>	
Uniform Observability	<i>pp.</i> 129 – 130
Uniformly Asymptotically Stable	<i>pp.</i> 100 – 104, 107 – 116
Uniformly Exponentially Stable	<i>pp.</i> 103 – 104, 107, 116 – 123
Uniformly Stable	<i>pp.</i> 100 – 102, 104, 107 – 114
Unitary Diagonal Coordinate Transformation	<i>p.</i> 79
<i>V</i>	
Van Der Pol Oscillator	<i>pp.</i> 11 – 12