

Michael J. Cloud Byron C. Drachman

Inequalities

With Applications to Engineering

With 14 Figures



Springer

Contents

Preface	v
1 Basic Review of Inequalities	1
1.1 Preliminaries	1
1.2 Elementary Properties and Survival Rules	2
1.3 Bounded Set Terminology	4
1.4 Quadratic Inequalities	5
1.5 Absolute Value and the Triangle Inequality	5
1.6 Miscellaneous Examples	10
1.7 Exercises	14
2 Methods from the Calculus	19
2.1 Introduction	19
2.2 Function Terminology and Facts	19
2.3 Basic Results for Integrals	21
2.4 Results from the Differential Calculus	23
2.5 Some Applications	27
2.6 Exercises	32
3 Some Standard Inequalities	37
3.1 Introduction	37
3.2 Bernoulli's Inequality	37
3.3 Young's Inequality	38
3.4 The Inequality of the Means	38

3.5	Hölder's Inequality	40
3.6	Minkowski's Inequality	43
3.7	The Cauchy-Schwarz Inequality	44
3.8	Chebyshev's Inequality	45
3.9	Jensen's Inequality	46
3.10	Exercises	49
4	Inequalities in Abstract Spaces	53
4.1	Introduction	53
4.2	Metric Spaces	53
4.3	Iteration in a Metric Space	56
4.4	Linear Spaces	57
4.5	Orthogonal Projection and Expansion	62
4.6	Exercises	65
5	Some Applications	67
5.1	Introduction	67
5.2	Estimation of Integrals	67
5.3	Series Expansions	68
5.4	Simpson's Rule	72
5.5	Taylor's Method	74
5.6	Special Functions of Mathematical Physics	77
5.7	A Projectile Problem	82
5.8	Geometric Shapes	84
5.9	Electrostatic Fields and Capacitance	88
5.10	Applications to Matrices	93
5.11	Topics in Signal Analysis	100
5.12	Dynamical System Stability and Control	103
5.13	Some Inequalities of Probability	110
5.14	Applications in Communication Systems	112
5.15	Existence of Solutions	115
5.16	A Duality Theorem and Cost Minimization	121
5.17	Exercises	123
Appendix	Hints for Selected Exercises	127
References		143
Index		147