Contents

Pretace		V11
Fr	equently Used Notation	ix
1	Basic Concepts	1
1	Phase Spaces and Phase Flows	1
2	Vector Fields on the Line	11
3	Phase Flows on the Line	19
4	Vector Fields and Phase Flows in the Plane	24
5	Nonautonomous Equations	28
6	The Tangent Space	33
2	Basic Theorems	48
7	The Vector Field near a Nonsingular Point	48
8	**	56
	Applications to Equations of Higher Order	59
	Phase Curves of Autonomous Systems	68
	The Directional Derivative. First Integrals	72
12	Conservative Systems with One Degree of Freedom	7 9
3	Linear Systems	95
13	Linear Problems	95
14	The Exponential of an Operator	97
15	Properties of the Exponential	104
16	The Determinant of the Exponential	111
17	The Case of Distinct Real Eigenvalues	115
	Complexification and Decomplexification	119
	Linear Equations with a Complex Phase Space	124
	Complexification of a Real Linear Equation	129
	Classification of Singular Points of Linear Systems	139
	Topological Classification of Singular Points	143
	Stability of Equilibrium Positions	154
	The Case of Purely Imaginary Eigenvalues	160
	The Case of Multiple Eigenvalues	167
	More on Quasi-Polynomials	176
	Nonautonomous Linear Equations	188
	Linear Equations with Periodic Coefficients	199
29	Variation of Constants	208

vi

211
211
213
223
233
233
243
250
254
269
273
273 975