

TABLE OF CONTENTS

CHAPTER I: General Theory of the Lie Series	
by W.GROEBNER	1
I.1 Definition and Convergence of the Lie Series	2
I.2 The Properties of Lie Series	13
I.3 The Remainder of Lie Series	26
I.4 The Solution of a Non-autonomous System of Differential Equation	32
I.5 General Perturbation Theory	34
I.6 Parameter Expansions of the Solutions of a System of Differential Equations by Re- arranging Lie Series	37
CHAPTER II: On the Numerical Treatment of Ordinary Differential Equations	
by H.KNAPP and G.WANNER	43
II.1 Formulas for the Initial Value Problem	44
II.2 A Further Derivation of the Solution Formulas	48
II.3 Considering Finite Sections of the Solution Formulas as Iteration Rules	52
II.4 Remarks on Numerical Calculations	62
II.5 Boundary Value Problems	67
II.6 A Somewhat More General Boundary Value Problem	71
II.7 Example from Celestial Mechanics	73
II.8 Van der Pol's Differential Equation	90
CHAPTER III: Invariant Functions and Characteristics belonging to Lie Operators	
by W.GROEBNER, H.REITBERGER and G.WANNER	99
III.1 Invariant Functions and Characteristics	100
III.2 Linear Differential Equations	104
III.3 Homogeneous Differential Equations in Two Dimensions	118

III.4	Expansion of the Solution of a System of Differential Equations in the Neighborhood of an Invariant Straight Line by Rearrangement of Lie Series	136
III.5	Extension to Holomorphic Coefficients	154
III.6	Systems of Linear Partial Differential Equations of First Order	159
CHAPTER IV: Nonlinear Partial Differential Equations of the First Order and Applications		
	by W.GROEBNER	179
IV.1	Solution of the General Partial Differential Equation of the First Order, Using Lie Series	180
IV.2	The Hamilton-Jacobi Theory	196
IV.3	Stability Investigation	212
CHAPTER V: Linear Partial Differential Equations of Higher Order		
	by W.GROEBNER and W.WATZLAWEK	221
V.1	Generalized Lie Series with Operators of Higher Order	222
V.2	On the Solution of Cauchy's Problem for Linear Partial Differential Equations of Higher Order	232
	Bibliography concerning Lie Series	255