## TABLE OF CONTENTS

	page
Foreword	III
Acknowledgement	IV
APL Glossary	V
1. BACKGROUND AND SCOPE	1
Part I: THE TENSORIAL APPROACH	5
Introduction	5
2. THE CARTESIAN TENSOR FORMULATION	6
2.1 The Basic Criteria	6
2.2 A Tensorial Power Series Representation	8
2.3 The Controllability Criterion Reformulated	11
2.4 The Observability Criterion Reformulated	15
2.5 Summing Up and Looking Ahead	18
3. THE BOOLEAN TENSOR FORMULATION	21
3.1 Representing Structures by Boolean Tensors	21
3.2 The Concept of Potential State Controllability	25
3.3 The Concept of Potential Observability	28
3.4 Summing Up and Looking Ahead	32
Conclusion	34
Part II: THE GRAPH THEORETIC APPROACH	35
Introduction	35
Introduction	
4. THE REACHABILITY CRITERION	37
4.1 A Digraph Interpretation	37
4.2 Applying the Reachability Matrix	41
4.3 A Basic Isomorphism	45
4.4 Some Group Theoretical Implications	47
5. THE TERM RANK CRITERION	51
5.1 The Alternating Path Method	51
5.2 Alternating Path Deformations	54
5.3 Assigning a Maximal Permutation Matrix	59
5.4 Testing the Augmented System	65
Conclusion	74

	page
Part III: DIGRAPH DECOMPOSITION AND TENSOR AGGREGATION	75
Introduction	75
6. ON PARTITIONING OF A DIGRAPH	76
6.1 The Structural Component Parts	76
6.2 Introducing Level Coding	79
6.3 Topological Ordering by Quasi-Levels	83
6.4 On Decomposable Systems	88
7. TOWARDS A TOTAL SYSTEMS DESCRIPTION	91
7.1 Establishing a Universal Tensor	91
7.2 On the Track of a New Duality	95
7.3 Output Controllability and Input Observability	102
7.4 A Few Computational Experiments	106
Conclusion	114
8. SOME GENERAL REMARKS	115
REFERENCES	118