Contents

1 Basic concepts **1**

1.1 Definitions and theorems used in the research 1

1.2 Transformation of derivatives 3

1.3 Completely integrable systems 5

1.4 The Lie linearization test 5

2 Linearization of system of three second-order ordinary differential equations via point transformations **10**

2.1 Introduction 10

2.1.1 Single second-order ordinary differential equation 10

2.1.2 System of two second-order ordinary differential equations 11

2.2 Necessary conditions for linearization 11

2.3 Sufficient conditions for linearization 25

2.4 Linearizing transformation 38

2.5 Flowchart of testing program 40

2.6 Examples 41

3 Group classification of systems of three second-order ordinary differential equations **51**

3.1 Introduction 51

3.2 Preliminary study of systems of nonlinear equations 53

3.2.1 Equivalence transformations 54

3.2.2 Determining equations 54

3.2.3 Case $\xi \neq 0$ 56

3.2.4 Case $\xi = 0$ 61

3.2.5 Case $A = J_2$ 63

3.3 Systems of linear equations 72

3.3.1 Equivalence transformations 73

3.3.2 Case $\xi \neq 0$ 73
3.3.3 Case $\xi = 0$ 76
3.4 Solutions of the determining equations 76
3.5 Conclusion 77