

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Differential Galois Theory</b>	
2.1	Algebraic groups	7
2.2	Classical approach	11
2.3	Meromorphic connections	15
2.4	The Tannakian approach	24
2.5	Stokes multipliers	25
2.6	Coverings and differential Galois groups	28
2.7	Kovacic's algorithm	29
2.8	Examples	33
2.8.1	The hypergeometric equation	33
2.8.2	The Bessel equation	34
2.8.3	The confluent hypergeometric equation	36
2.8.4	The Lamé equation	37
<b>3</b>	<b>Hamiltonian Systems</b>	
3.1	Definitions	44
3.2	Complete integrability	48
3.3	Three non-integrability theorems	52
3.4	Some properties of Poisson algebras	57
<b>4</b>	<b>Non-integrability Theorems</b>	
4.1	Variational equations	66
4.1.1	Singular curves	66
4.1.2	Meromorphic connection associated with the variational equation	70
4.1.3	Reduction to normal variational equations	72
4.1.4	Reduction from the Tannakian point of view	78
4.2	Main results	80
4.3	Examples	90

<b>5</b>	<b>Three Models</b>	
5.1	Homogeneous potentials . . . . .	97
5.1.1	The model . . . . .	97
5.1.2	Non-integrability theorem . . . . .	98
5.1.3	Examples . . . . .	101
5.2	The Bianchi IX cosmological model . . . . .	105
5.2.1	The model . . . . .	105
5.2.2	Non-integrability . . . . .	107
5.3	Sitnikov's Three-Body Problem . . . . .	109
5.3.1	The model . . . . .	109
5.3.2	Non-integrability . . . . .	110
<b>6</b>	<b>An Application of the Lamé Equation</b>	
6.1	Computation of the potentials . . . . .	112
6.2	Non-integrability criterion . . . . .	115
6.3	Examples . . . . .	123
6.4	The homogeneous Hénon-Heiles potential . . . . .	126
<b>7</b>	<b>A Connection with Chaotic Dynamics</b>	
7.1	Grotta-Ragazzo interpretation of Lerman's theorem . . . . .	132
7.2	Differential Galois approach . . . . .	133
7.3	Example . . . . .	135
<b>8</b>	<b>Complementary Results and Conjectures</b>	
8.1	Two additional applications . . . . .	139
8.2	A conjecture about the dynamic . . . . .	142
8.3	Higher-order variational equations . . . . .	142
8.3.1	A conjecture . . . . .	142
8.3.2	An application . . . . .	146
<b>A</b>	<b>Meromorphic Bundles</b> . . . . .	149
<b>B</b>	<b>Galois Groups and Finite Coverings</b> . . . . .	153
<b>C</b>	<b>Connections with Structure Group</b> . . . . .	157
	<b>Bibliography</b> . . . . .	159
	<b>Index</b> . . . . .	167

Differential Galois Theory and Non-Integrability of  
Hamiltonian Systems

Morales-Ruiz, J.

1999, XIV, 167 p. 5 illus., Softcover

ISBN: 978-3-0348-0720-3

A product of Birkhäuser Basel