

## CONTENTS

### LECTURES

#### **Vladimir S. Gerdjikov and David J. Kaup**

HOW MANY TYPES OF SOLITON SOLUTIONS DO WE KNOW?.....	<b>11</b>
1. Introduction.....	11
2. Zakharov–Shabat System and $\mathfrak{sl}(2)$ Solitons.....	13
3. Generalized Zakharov–Shabat System and $\mathfrak{sl}(n)$ Solitons.....	19
4. Eigenfunctions and Eigensubspaces.....	27
5. Discussion and Further Studies.....	30
Appendix A.....	31
References.....	32

#### **Joseph M. Landsberg**

EXTERIOR DIFFERENTIAL SYSTEMS AND BILLIARDS.....	<b>35</b>
1. Introduction.....	35
2. Origin of the Billiard Problem.....	36
3. Billiards.....	36
4. Setting up the Problem.....	38
5. EDS Terminology.....	40
6. PDE and EDS.....	41
7. Cartan’s Test.....	43
8. First Examples of Cartan’s Test.....	45
9. Periodic Billiard Orbits.....	48
10. Three Periodic Billiard Orbits.....	50
11. A Few Successes of the Cartan–Kähler Theorem.....	51
References.....	53

CONTRIBUTIONS

**Boyka Aneva**

QUANTUM GROUPS AND STOCHASTIC MODELS..... 57

**Omar Cherbal and Mahrez Drir**

DISSIPATIVE TWO-LEVEL SPIN SYSTEM AND GEOMETRICAL  
PHASE ..... 79

**Yong Seung Cho and Myung Im Lim**

FLUX CONJECTURE ON SYMPLECTIC SUBMANIFOLDS ..... 89

**Georgi K. Dimitrov and Ivaïlo M. Mladenov**

A NEW FORMULA FOR THE EXPONENTS OF THE GENERATORS OF  
THE LORENTZ GROUP ..... 98

**Arturo Echeverría-Enríquez, Manuel de León, Miguel C. Muñoz-Lecanda  
and Narciso Román-Roy**

EXTENDED HAMILTONIAN FORMALISM OF FIELD THEORIES:  
VARIATIONAL ASPECTS AND OTHER TOPICS ..... 116

**Mohammad A. Fasihi**

ONE DIMENSIONAL QUASI-EXACTLY SOLVABLE DIFFERENTIAL  
EQUATIONS ..... 128

**Pedro L. García and César Rodrigo**

CARTAN FORMS AND SECOND VARIATION FOR CONSTRAINED  
VARIATIONAL PROBLEMS ..... 140

**Georgi G. Grahovski, Vladimir S. Gerdjikov, Nikolay A. Kostov and Victor  
A. Atanasov**

NEW INTEGRABLE MULTI-COMPONENT NLS TYPE EQUATIONS ON  
SYMMETRIC SPACES:  $\mathbb{Z}_4$  AND  $\mathbb{Z}_6$  REDUCTIONS ..... 154

<b>Mariana Hadzhilazova and Ivailo M. Mladenov</b>	
MEMBRANE APPROACH TO BALLOONS AND SOME RELATED SURFACES .....	176
<b>Thomas A. Ivey</b>	
GEOMETRY AND TOPOLOGY OF FINITE-GAP VORTEX FILAMENTS	187
<b>Assen Kyuldjiev, Vladimir Gerdjikov, Giuseppe Marmo and Gaetano Vilasi</b>	
MANEV PROBLEM AND ITS REAL FORM DYNAMICS: SUPERINTEGRABILITY AND SYMMETRY ALGEBRAS.....	203
<b>Khanlar R. Mamedov</b>	
ON A BASIC PROBLEM FOR A SECOND ORDER DIFFERENTIAL EQUATION WITH A DISCONTINUOUS COEFFICIENT AND A SPECTRAL PARAMETER IN THE BOUNDARY CONDITIONS .....	218
<b>Hamza Menken and Khanlar R. Mamedov</b>	
ON THE INVERSE PROBLEM OF THE SCATTERING THEORY FOR A BOUNDARY-VALUE PROBLEM.....	226
<b>Zhan-Chun Tu and Zhong-Can Ou-Yang</b>	
VARIATIONAL PROBLEMS IN ELASTIC THEORY OF BIOMEMBRANES, SMECTIC-A LIQUID CRYSTALS, AND CARBON RELATED STRUCTURES .....	237
<b>Abraham A. Ungar</b>	
THE RELATIVISTIC HYPERBOLIC PARALLELOGRAM LAW.....	249
<b>Vassil M. Vassilev, Peter A. Djondjorov and Ivailo M. Mladenov</b>	
SYMMETRY GROUPS, CONSERVATION LAWS AND GROUP-INVARIANT SOLUTIONS OF THE MEMBRANE SHAPE EQUATION ...	265
<b>Sergey Yu. Vernov</b>	
PAINLEVÉ ANALYSIS AND EXACT SOLUTIONS OF NONINTEGRABLE SYSTEMS .....	280

<b>Alexander Yampolsky</b> ON SPECIAL TYPES OF MINIMAL AND TOTALLY GEODESIC UNIT VECTOR FIELDS .....	<b>292</b>
<b>Alexander B. Yanovski</b> COMPATIBLE POISSON TENSORS RELATED TO BUNDLES OF LIE ALGEBRAS .....	<b>307</b>
<b>Ivaylo Zlatanov, Thomas Groth and George Altankov</b> QUANTIFICATION OF IMAGE DATA AND A KINETIC MODEL FOR THE INTEGRIN RECEPTOR MOVEMENT ON THE SURFACE OF LIVING CELLS .....	<b>320</b>
<i>Subject Index</i> .....	<b>337</b>
<i>E-mail Addresses</i> .....	<b>339</b>