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LIST OF C.I.M.E. SEMINARS		Publisher
1954 -	1. Analisi funzionale	C.I.M.E.
	2. Quadratura delle superficie e questioni connesse	"
	3. Equazioni differenziali non lineari	"
1955 -	4. Teorema di Riemann-Roch e questioni connesse	"
	5. Teoria dei numeri	"
	6. Topologia	"
	7. Teorie non linearizzate in elasticità, idrodinamica,aerodinamica	"
	8. Geometria proiettivo-differenziale	"
1956 -	9. Equazioni alle derivate parziali a caratteristiche reali	"
	10. Propagazione delle onde elettromagnetiche	"
	11. Teoria della funzioni di più variabili complesse e delle funzioni automorfe	"
1957 -	12. Geometria aritmetica e algebrica (2 vol.)	"
	13. Integrali singolari e questioni connesse	"
	14. Teoria della turbolenza (2 vol.)	"
1958 -	15. Vedute e problemi attuali in relatività generale	"
	16. Problemi di geometria differenziale in grande	"
	17. Il principio di minimo e le sue applicazioni alle equazioni funzionali	"
1959 -	18. Induzione e statistica	"
	19. Teoria algebrica dei meccanismi automatici (2 vol.)	"
	20. Gruppi, anelli di Lie e teoria della coomologia	"
1960 -	21. Sistemi dinamici e teoremi ergodici	"
	22. Forme differenziali e loro integrali	"
1961 -	23. Geometria del calcolo delle variazioni (2 vol.)	"
	24. Teoria delle distribuzioni	"
	25. Onde superficiali	"
1962 -	26. Topologia differenziale	"
	27. Autovalori e autosoluzioni	"
	28. Magnetofluidodinamica	"

1963 - 29. Equazioni differenziali astratte "
30. Funzioni e varietà complesse "
31. Proprietà di media e teoremi di confronto in Fisica Matematica "

1964 - 32. Relatività generale "
33. Dinamica dei gas rarefatti "
34. Alcune questioni di analisi numerica "
35. Equazioni differenziali non lineari "

1965 - 36. Non-linear continuum theories "
37. Some aspects of ring theory "
38. Mathematical optimization in economics "

1966 - 39. Calculus of variations Ed. Cremonese, Firenze
40. Economia matematica "
41. Classi caratteristiche e questioni connesse "
42. Some aspects of diffusion theory "

1967 - 43. Modern questions of celestial mechanics "
44. Numerical analysis of partial differential equations "
45. Geometry of homogeneous bounded domains "

1968 - 46. Controllability and observability "
47. Pseudo-differential operators "
48. Aspects of mathematical logic "

1969 - 49. Potential theory "
50. Non-linear continuum theories in mechanics and physics and their applications "
51. Questions of algebraic varieties "

1970 - 52. Relativistic fluid dynamics "
53. Theory of group representations and Fourier analysis "
54. Functional equations and inequalities "
55. Problems in non-linear analysis "

1971 - 56. Stereodynamics "
57. Constructive aspects of functional analysis (2 vol.) "
58. Categories and commutative algebra "

1972 -	59. Non-linear mechanics	"
	60. Finite geometric structures and their applications	"
	61. Geometric measure theory and minimal surfaces	"
1973 -	62. Complex analysis	"
	63. New variational techniques in mathematical physics	"
	64. Spectral analysis	"
1974 -	65. Stability problems	"
	66. Singularities of analytic spaces	"
	67. Eigenvalues of non linear problems	"
1975 -	68. Theoretical computer sciences	"
	69. Model theory and applications	"
	70. Differential operators and manifolds	"
1976 -	71. Statistical Mechanics	Ed Liguori, Napoli
	72. Hyperbolicity	"
	73. Differential topology	"
1977 -	74. Materials with memory	"
	75. Pseudodifferential operators with applications	"
	76. Algebraic surfaces	"
1978 -	77. Stochastic differential equations	"
	78. Dynamical systems	Ed Liguori, Napoli and Birhäuser Verlag
1979 -	79. Recursion theory and computational complexity	"
	80. Mathematics of biology	"
1980 -	81. Wave propagation	"
	82. Harmonic analysis and group representations	"
	83. Matroid theory and its applications	"
1981 -	84. Kinetic Theories and the Boltzmann Equation (LNM 1048)	Springer-Verlag
	85. Algebraic Threefolds (LNM 947)	"
	86. Nonlinear Filtering and Stochastic Control (LNM 972)	"
1982 -	87. Invariant Theory (LNM 996)	"
	88. Thermodynamics and Constitutive Equations (LN Physics 228)	"
	89. Fluid Dynamics (LNM 1047)	"

1983 -	90.	Complete Intersections	(LNM 1092)	Springer-Verlag
	91.	Bifurcation Theory and Applications	(LNM 1057)	"
	92.	Numerical Methods in Fluid Dynamics	(LNM 1127)	"
1984 -	93.	Harmonic Mappings and Minimal Immersions	(LNM 1161)	"
	94.	Schrödinger Operators	(LNM 1159)	"
	95.	Buildings and the Geometry of Diagrams	(LNM 1181)	"
1985 -	96.	Probability and Analysis	(LNM 1206)	"
	97.	Some Problems in Nonlinear Diffusion	(LNM 1224)	"
	98.	Theory of Moduli	(LNM 1337)	"
1986 -	99.	Inverse Problems	(LNM 1225)	"
	100.	Mathematical Economics	(LNM 1330)	"
	101.	Combinatorial Optimization	(LNM 1403)	"
1987 -	102.	Relativistic Fluid Dynamics	(LNM 1385)	"
	103.	Topics in Calculus of Variations	(LNM 1365)	"
1988 -	104.	Logic and Computer Science	(LNM 1429)	"
	105.	Global Geometry and Mathematical Physics	(LNM 1451)	"
1989 -	106.	Methods of nonconvex analysis	(LNM 1446)	"
	107.	Microlocal Analysis and Applications	(LNM 1495)	"
1990 -	108.	Geometric Topology: Recent Developments	(LNM 1504)	"
	109.	H_{∞} Control Theory	(LNM 1496)	"
	110.	Mathematical Modelling of Industrial Processes	(LNM 1521)	"
1991 -	111.	Topological Methods for Ordinary Differential Equations	(LNM 1537)	"
	112.	Arithmetic Algebraic Geometry	(LNM 1553)	"
	113.	Transition to Chaos in Classical and Quantum Mechanics	(LNM 1589)	"
1992 -	114.	Dirichlet Forms	(LNM 1563)	"
	115.	D-Modules, Representation Theory, and Quantum Groups	(LNM 1565)	"
	116.	Nonequilibrium Problems in Many-Particle Systems	(LNM 1551)	"

1993 -	117.	Integrable Systems and Quantum Groups	(LNM 1620)	Springer-Verlag
	118.	Algebraic Cycles and Hodge Theory	(LNM 1594)	
	119.	Phase Transitions and Hysteresis	(LNM 1584)	"
1994 -	120.	Recent Mathematical Methods in Nonlinear Wave Propagation	(LNM 1640)	"
	121.	Dynamical Systems	(LNM 1609)	"
	122.	Transcendental Methods in Algebraic Geometry	(LNM 1646)	"
1995 -	123.	Probabilistic Models for Nonlinear PDE's	(LNM 1627)	"
	124.	Viscosity Solutions and Applications	(LNM 1660)	"
	125.	Vector Bundles on Curves. New Directions	(LNM 1649)	"
1996 -	126.	Integral Geometry, Radon Transforms and Complex Analysis	(LNM 1684)	"
	127.	Calculus of Variations and Geometric Evolution Problems	LNM 1713	
	128.	Financial Mathematics	LNM 1656	"
1997 -	129.	Mathematics Inspired by Biology	LNM 1714	
	130.	Advanced Numerical Approximation of Nonlinear Hyperbolic Equations	LNM 1697	
	131.	Arithmetic Theory of Elliptic Curves	LNM 1716r	"
	132.	Quantum Cohomology	to appear	"
1998 -	133.	Optimal Shape Design	to appear	
	134.	Dynamical Systems and Small Divisors	to appear	
	135.	Mathematical Problems in Semiconductor Physics	to appear	
	136.	Stochastic PDE's and Kolmogorov Equations in Infinite Dimension	LNM 1715	
	137.	Filtration in Porous Media and Industrial Applications	to appear	
1999 -	138.	Computional Mathematics driven by Industrual Applicationa	to appear	
	139.	Iwahori-Hecke Algebras and Representation Theory	to appear	
	140.	Theory and Applications of Hamiltonian Dynamics	to appear	

141. Global Theory of Minimal Surfaces in Flat Spaces — to appear

142. Direct and Inverse Methods in Solving Nonlinear Evolution Equations — to appear

FONDAZIONE C.I.M.E.
CENTRO INTERNAZIONALE MATEMATICO ESTIVO
INTERNATIONAL MATHEMATICAL SUMMER CENTER

"Computational Mathematics driven by Industrial Applications"

is the subject of the first 1999 C.I.M.E. Session.

The session, sponsored by the Consiglio Nazionale delle Ricerche (C.N.R.), the Ministero dell'Università e della Ricerca Scientifica e Tecnologica (M.U.R.S.T.) and the European Community, will take place, under the scientific direction of Professors Vincenzo CAPASSO (Università di Milano), Heinz W. ENGL (Johannes Kepler Universitaet, Linz) and Doct. Jacques PERIAUX (Dassault Aviation) at the Ducal Palace of Martina Franca (Taranto), from 21 to 27 June, 1999.

Courses

a) Paths, trees and flows: graph optimisation problems with industrial applications (5 lectures in English) Prof. Rainer BURKARD (Technische Universität Graz)

Abstract

Graph optimisation problems play a crucial role in telecommunication, production, transportation, and many other industrial areas. This series of lectures shall give an overview about exact and heuristic solution approaches and their inherent difficulties. In particular the essential algorithmic paradigms such as greedy algorithms, shortest path computation, network flow algorithms, branch and bound as well as branch and cut, and dynamic programming will be outlined by means of examples stemming from applications.

References

1) R. K. Ahuja, T. L. Magnanti & J. B. Orlin, *Network Flows: Theory, Algorithms and Applications*, Prentice Hall, 1993

2) R. K. Ahuja, T. L. Magnanti, J.B.Orlin & M. R. Reddy, *Applications of Network Optimization.* Chapter 1 in: Network Models (Handbooks of Operations Research and Management Science, Vol. 7), ed. by M. O. Ball et al., North Holland 1995, pp. 1-83

3) R. E. Burkard & E. Cela, *Linear Assignment Problems and Extensions,* Report 127, June 1998 (to appear in Handbook of Combinatorial Optimization, Kluwer, 1999).

Can be downloaded by anonymous ftp from

ftp.tu-graz.ac.at, directory/pub/papers/math

4) R. E. Burkard, E. Cela, P. M. Pardalos & L. S. Pitsoulis, *The Quadratic Assignment Problem*, Report 126 May 1998 (to appear in Handbook of Combinatorial Optimization, Kluwer, 1999). Can be downloaded by anonymous ftp from ftp.tu-graz.ac.at, directory /pub/papers/math.

5) E. L. Lawler, J. K. Lenstra, A. H. G.Rinnooy Kan & D. B. Shmoys (Eds.), *The Travelling Salesman Problem*, Wiley, Chichester, 1985.

b) New Computational Concepts, Adaptive Differential Equations Solvers and Virtual Labs (5 lectures in English) Prof. Peter DEUFLHARD (Konrad Zuse Zentrum, Berlin).

Abstract

The series of lectures will address computational mathematical projects that have been tackled by the speaker and his group. In all the topics to be presented novel mathematical modelling, advanced algorithm developments. and efficient visualisation play a joint role to solve problems of practical relevance. Among the applications to be exemplified are:

1) Adaptive multilevel FEM in clinical cancer therapy planning;

2) Adaptive multilevel FEM in optical chip design;

3) Adaptive discrete Galerkin methods for countable ODEs in polymer chemistry;

4) Essential molecular dynamics in RNA drug design.

References

1) P. Deuflhard & A Hohmann, *Numerical Analysis. A first Course in Scientific Computation*, Verlag de Gruyter, Berlin, 1995

2) P. Deuflhard et al *A nonlinear multigrid eigenproblem solver for the complex Helmoltz equation*, Konrad Zuse Zentrum Berlin SC 97-55 (1997)

3) P. Deuflhard et al. *Recent developments in chemical computing*, Computers in Chemical Engineering, **14**, (1990),pp.1249-1258.

4) P. Deuflhard et al. (eds) *Computational molecular dynamics: challenges, methods, ideas*, Lecture Notes in Computational Sciences and Engineering, vol.4 Springer Verlag, Heidelberg, 1998.

5) P.Deuflhard & M. Weiser, *Global inexact Newton multilevel FEM for nonlinear elliptic problems*, Konrad Zuse Zentrum SC 96-33, 1996.

c) **Computational Methods for Aerodynamic Analysis and Design.** (5 lectures in English) Prof. Antony JAMESON (Stanford University, Stanford).

Abstract

The topics to be discussed will include: - Analysis of shock capturing schemes, and fast solution algorithms for compressible flow; - Formulation of aerodynamic shape optimisation based on control theory; - Derivation of the adjoint equations for compressible flow modelled by the potential Euler and Navies-Stokes equations; - Analysis of alternative numerical search procedures; - Discussion of geometry control and mesh perturbation methods; - Discussion of numerical implementation and practical applications to aerodynamic design.

d) **Mathematical Problems in Industry** (5 lectures in English) Prof. Jacques-Louis LIONS (Collège de France and Dassault Aviation, France).

Abstract

1. Interfaces and scales. The industrial systems are such that for questions of reliability, safety, cost no subsystem can be underestimated. Hence the need to address problems of scales, both in space variables and in time and the crucial importance of modelling and numerical methods.

2. Examples in Aerospace Examples in Aeronautics and in Spatial Industries. Optimum design.

3. Comparison of problems in Aerospace and in Meteorology. Analogies and differences

4 Real time control. Many methods can be thought of. Universal decomposition methods will be presented.

References

1) J. L. Lions, *Parallel stabilization hyperbolic and Petrowsky systems*, WCCM4 Conference, CDROM Proceedings, Buenos Aires, June 29- July 2, 1998.

2) W. Annacchiarico & M. Cerolaza, *Structural shape optimization of 2-D finite elements models using Beta-splines and genetic algorithms*, WCCM4 Conference, CDROM Proceedings, Buenos Aires, June 29- July 2, 1998.

3) J. Periaux, M. Sefrioui & B. Mantel, *Multi-objective strategies for complex optimization problems in aerodynamics using genetic algorithms*, ICAS '98 Conference, Melbourne, September '98, ICAS paper 98-2.9.1

e) Wavelet transforms and Cosine Transform in Signal and Image Processing (5 lectures in English) Prof. Gilbert STRANG (MIT, Boston).

Abstract

In a series of lectures we will describe how a linear transform is applied to the sampled data in signal processing, and the transformed data is compressed (and quantized to a string of bits). The quantized signal is transmitted and then the inverse transform reconstructs a very good approximation to the original signal. Our analysis concentrates on the construction of the transform. There are several important constructions and we emphasise two: 1) the discrete cosine transform (DCT); 2) discrete wavelet transform (DWT). The DCT is an orthogonal transform (for which we will give a new proof). The DWT may be orthogonal, as for the Daubechies family of wavelets. In other cases it may be biorthogonal - so the reconstructing transform is the inverse but not the transpose of the analysing transform. The reason for this possibility is that orthogonal wavelets cannot also be symmetric, and symmetry is essential property in image processing (because our visual system objects to lack of symmetry). The wavelet construction is based on a "bank" of filters - often a low pass and high pass filter. By iterating the low pass filter we decompose the input space into "scales" to produce a multiresolution. An infinite iteration yields in the limit the scaling function and a wavelet: the crucial equation for the theory is the refinement equation or dilatation equation that yields the scaling function. We discuss the mathematics of the refinement equation: the existence and the smoothness of the solution, and the construction by the cascade algorithm. Throughout these lectures we will be developing the mathematical ideas, but always for a purpose. The insights of wavelets have led to new bases for function spaces and there is no doubt that other ideas are waiting to be developed. This is applied mathematics.

References

1) I. Daubechies, *Ten lectures on wavelets*, SIAM, 1992.

2) G. Strang & T. Nguyen, *Wavelets and filter banks*, Wellesley-Cambridge, 1996.

3) Y. Meyer, *Wavelets: Algorithms and Applications*, SIAM, 1993.

Seminars

Two hour seminars will be held by the Scientific Directors and Professor R. Mattheij.

1) **Mathematics of the crystallisation process of polymers.** Prof. Vincenzo CAPASSO (Un. di Milano).

2) **Inverse Problems: Regularization methods, Application in Industry**. Prof. H. W. ENGL (Johannes Kepler Un., Linz).

3) **Mathematics of Glass.** Prof. R. MATTHEIJ (TU Eindhoven).

4) **Combining game theory and genetic algorithms for solving multi-objective shape optimization problems in Aerodynamics Engineering**. Doct. J. PERIAUX (Dassault Aviation).

Applications

Those who want to attend the Session should fill in an application to C.I.M.E Foundation at the address below, **not later than April 30**, 1999. An important consideration in the acceptance of applications is the scientific relevance of the Session to the field of interest of the applicant. Applicants are requested, therefore, to submit, along with their application, a scientific curriculum and a letter of recommendation. Participation will only be allowed to persons who have applied in due time and have had their application accepted. CIME will be able to partially support some of the youngest participants. Those who plan to apply for support have to mention it explicitely in the application form.

Attendance

No registration fee is requested. Lectures will be held at Martina Franca on June 21, 22, 23, 24, 25, 26, 27. Participants are requested to register on June 20, 1999.

Site and lodging

Martina Franca is a delightful baroque town of white houses of Apulian spontaneous architecture. Martina Franca is the major and most aristocratic centre of the "Murgia dei Trulli" standing on an hill which dominates the well known Itria valley spotted with "Trulli" conical dry stone houses which go back to the 15th century. A masterpiece of baroque architecture is the Ducal palace where the workshop will be hosted. Martina Franca is part of the province of Taranto, one of the major centres of Magna Grecia, particularly devoted to mathematics. Taranto houses an outstanding museum of Magna Grecia with fabulous collections of gold manufactures.

Lecture Notes

Lecture notes will be published as soon as possible after the Session.

Arrigo CELLINA CIME Director	Vincenzo VESPRI CIME Secretary

Fondazione C.I.M.E. c/o Dipartimento di Matematica ?U. Dini? Viale Morgagni, 67/A - 50134 FIRENZE (ITALY) Tel. +39-55-434975 / +39-55-4237123 FAX +39-55-434975 / +39-55-4222695 E-mail CIME@UDINI.MATH.UNIFI.IT

Information on CIME can be obtained on the system World-Wide-Web on the file HTTP: //WWW.MATH.UNIFI.IT/CIME/WELCOME.TO.CIME

FONDAZIONE C.I.M.E.
CENTRO INTERNAZIONALE MATEMATICO ESTIVO
INTERNATIONAL MATHEMATICAL SUMMER CENTER

"Iwahori-Hecke Algebras and Representation Theory"

is the subject of the second 1999 C.I.M.E. Session.

The session, sponsored by the Consiglio Nazionale delle Ricerche (C.N.R.), the Ministero dell'Università e della Ricerca Scientifica e Tecnologica (M.U.R.S.T.) and the European Community, will take place, under the scientific direction of Professors Velleda BALDONI (Università di Roma "Tor Vergata") and Dan BARBASCH (Cornell University) at the Ducal Palace of Martina Franca (Taranto), from June 28 to July 6, 1999.

Courses

a) Double HECKE algebras and applications (6 lectures in English)
Prof. Ivan CHEREDNIK (Un. of North Carolina at Chapel Hill, USA)
Abstract:
The starting point of many theories in the range from arithmetic and harmonic analysis to path integrals and matrix models is the formula:

$$\Gamma(k+1/2) \; = \; 2\int_0^\infty e^{-x^2}x^{2k}dx.$$

Recently a q-generalization was found based on the Hecke algebra technique, which completes the 15 year old Macdonald program.

The course will be about applications of the double affine Hecke algebras (mainly one-dimensional) to the Macdonald polynomials, Verlinde algebras, Gauss integrals and sums. It will be understandable for those who are not familiar with Hecke algebras and (hopefully) interesting to the specialists.

1) *q-Gauss integrals.* We will introduce a q-analogue of the classical integral formula for the gamma-function and use it to generalize the Gaussian sums at roots of unity.

2) *Ultraspherical polynomials.* A connection of the q-ultraspherical polynomials (the Rogers polynomials) with the one-dimensional double affine Hecke algebra will be established.

3) *Duality.* The duality for these polynomials (which has no classical counterpart) will be proved via the double Hecke algebras in full details.

4) *Verlinde algebras.* We will study the polynomial representation of the 1-dim. DHA at roots of unity, which leads to a generalization and a simplification of the Verlinde algebras.

5) *$PSL_2(\mathbf{Z})$-action.* The projective action of the $PSL_2(\mathbf{Z})$ on DHA and the generalized Verlinde algebras will be considered for A_1 and arbitrary root systems.

6) *Fourier transform of the q-Gaussian.* The invariance of the q-Gaussian with respect to the q-Fourier transform and some applications will be discussed.

References:

1) *From double Hecke algebra to analysis*, Proceedings of ICM98, Documenta Mathematica (1998).

2) *Difference Macdonald–Mehta conjecture*, IMRN:10, 449–467 (1997).

3) *Lectures on Knizhnik-Zamolodchikov equations and Hecke algebras*, MSJ Memoirs (1997).

b) Representation theory of affine Hecke algebras

Prof. Gert HECKMAN (Catholic Un., Nijmegen, Netherlands)

Abstract.

1. The Gauss hypergeometric equation.
2. Algebraic aspects of the hypergeometric system for root systems.
3. The hypergeometric function for root systems.
4. The Plancherel formula in the hypergeometric context.
5. The Lauricella hypergeometric function.
6. A root system analogue of 5.

I will assume that the audience is familiar with the classical theory of ordinary differential equations in the complex plane, in particular the concept of regular singular points and monodromy (although in my first lecture I will give a brief review of the Gauss hypergeometric function). This material can be found in many text books, for example E.L. Ince, Ordinary differential equations, Dover Publ, 1956. E.T. Whittaker and G.N. Watson, A course of modern analysis, Cambridge University Press, 1927.

I will also assume that the audience is familiar with the theory of root systems and reflection groups, as can be found in N. Bourbaki, Groupes et algèbres de Lie, Ch. 4,5 et 6, Masson, 1981. J. E. Humphreys, Reflection groups and Coxeter groups, Cambridge University Press, 1990. or in one of the text books on semisimple groups.

For the material covered in my lectures references are W.J. Couwenberg, Complex reflection groups and hypergeometric functions, Thesis Nijmegen, 1994. G.J. Heckman, Dunkl operators, Sem Bourbaki no 828, 1997. E.M. Opdam, Lectures on Dunkl operators, preprint 1998.

c) Representations of affine Hecke algebras.

Prof. George LUSZTIG (MIT, Cambridge, USA)

Abstract

Affine Hecke algebras appear naturally in the representation theory of p-adic groups. In these lectures we will discuss the representation theory of affine Hecke algebras and their graded version using geometric methods such as equivariant K-theory or perverse sheaves.

References.

1. V. Ginzburg, *Lagrangian construction of representations of Hecke algebras*, Adv. in Math. 63 (1987), 100-112.

2. D. Kazhdan and G. Lusztig, *Proof of the Deligne-Langlands conjecture for Hecke algebras.*, Inv. Math. 87 (1987), 153-215.

3. G. Lusztig, *Cuspidal local systems and graded Hecke algebras, I*, IHES Publ. Math. 67 (1988),145-202; II, in "Representation of groups" (ed. B. Allison and G. Cliff), Conf. Proc. Canad. Math. Soc.. 16, Amer. Math. Soc. 1995, 217-275.

4. G. Lusztig, *Bases in equivariant K-theory, Represent. Th.*, 2 (1998).

d) Affine-like Hecke Algebras and p-adic representation theory

Prof. Roger HOWE (Yale Un., New Haven, USA)

Abstract

Affine Hecke algebras first appeared in the study of a special class of representations (the spherical principal series) of reductive groups with coefficients in p-adic fields. Because of their connections with this and other topics, the structure and representation theory of affine Hecke algebras has been intensively studied by a variety of authors. In the meantime, it has gradually emerged that affine Hecke algebras, or slight generalizations of them, allow one to understand far more of the representations of p-adic groups than just the spherical principal series. Indeed, it seems possible that such algebras will allow one to understand all representations of p-adic groups. These lectures will survey progress in this approach to p-adic representation theory.

Topics:

1) Generalities on spherical function algebras on p-adic groups.

2) Iwahori Hecke algebras and generalizations.

3) - 4) Affine Hecke algebras and harmonic analysis

5) - 8) Affine-like Hecke algebras and representations of higher level.

References:

J. Adler, *Refined minimal K-types and supercuspidal representations*, Ph.D. Thesis, University of Chicago.

D. Barbasch, *The spherical dual for p-adic groups*, in Geometry and Representation Theory of Real and p-adic Groups, J. Tirao, D. Vogan, and J. Wolf, eds, Prog. In Math. 158, Birkhauser Verlag, Boston, 1998, 1 - 20.

D. Barbasch and A. Moy, *A unitarity criterion for p-adic groups*, Inv. Math. 98 (1989), 19 - 38.

D. Barbasch and A. Moy, *Reduction to real infinitesimal character in affine Hecke algebras*, J. A. M. S.6 (1993), 611- 635.

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C. Bushnell and P. Kutzko, *The admissible dual of GL(N) via open subgroups*, Ann. of Math. Stud. 129, Princeton University Press, Princeton, NJ, 1993.

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R. Howe and A. Moy, *Hecke algebra isomorphisms for GL(N) over a p-adic field*, J. Alg. 131 (1990), 388 - 424.

J-L. Kim, *Hecke algebras of classical groups over p-adic fields and supercuspidal representations,I, II, III*, preprints, 1998.

G. Lusztig, *Classification of unipotent representations of simple p-adic groups*, IMRN 11 (1995), 517 - 589.

G. Lusztig, *Affine Hecke algebras and their graded version*, J. A. M. S. 2 (1989), 599 - 635.

L. Morris, *Tamely ramified supercuspidal representations of classical groups, I, II*, Ann. Ec. Norm. Sup 24, (1991) 705 - 738; 25 (1992), 639 - 667.

L. Morris, *Tamely ramified intertwining algebras*, Inv. Math. 114 (1994), 1 - 54.

A. Roche, *Types and Hecke algebras for principal series representations of split reductive p-adic groups*, preprint, (1996).

J-L. Waldspurger, *Algebres de Hecke et induites de representations cuspidales pour GLn*, J. reine u. angew. Math. 370 (1986), 27 - 191.

J-K. Yu, *Tame construction of supercuspidal representations*, preprint, 1998.

Applications

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Attendance

No registration fee is requested. Lectures will be held at Martina Franca on June 28, 29, 30, July 1, 2, 3, 4, 5, 6. Participants are requested to register on June 27, 1999.

Site and lodging

Martina Franca is a delightful baroque town of white houses of Apulian spontaneous architecture. Martina Franca is the major and most aristocratic centre of the Murgia dei Trulli standing on an hill which dominates the well known Itria valley spotted with Trulli conical dry stone houses which go back to the 15th century. A masterpiece of baroque architecture is the Ducal palace where the workshop will be hosted. Martina Franca is part of the province of Taranto, one of the major centres of Magna Grecia, particularly devoted to mathematics. Taranto houses an outstanding museum of Magna Grecia with fabulous collections of gold manufactures.

Lecture Notes

Lecture notes will be published as soon as possible after the Session.

Arrigo CELLINA
CIME Director

Vincenzo VESPRI
CIME Secretary

Fondazione C.I.M.E. c/o Dipartimento di Matematica U. Dini Viale Morgagni, 67/A - 50134 FIRENZE (ITALY) Tel. +39-55-434975 / +39-55-4237123 FAX +39-55-434975 / +39-55-4222695 E-mail CIME@UDINI.MATH.UNIFI.IT

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FONDAZIONE C.I.M.E.
CENTRO INTERNAZIONALE MATEMATICO ESTIVO
INTERNATIONAL MATHEMATICAL SUMMER CENTER

"Theory and Applications of Hamiltonian Dynamics"

is the subject of the third 1999 C.I.M.E. Session.

The session, sponsored by the Consiglio Nazionale delle Ricerche (C.N.R.), the Ministero dell'Università e della Ricerca Scientifica e Tecnologica (M.U.R.S.T.) and the European Community, will take place, under the scientific direction of Professor Antonio GIORGILLI (Un. di Milano), at Grand Hotel San Michele,Cetraro (Cosenza), from July 1 to July 10, 1999.

Courses

a) Physical applications of Nekhoroshev theorem and exponential estimates (6 lectures in English)

Prof. Giancarlo BENETTIN (Un. di Padova, Italy)

Abstract

The purpose of the lectures is to introduce exponential estimates (i.e., construction of normal forms up to an exponentially small remainder) and Nekhoroshev theorem (exponential estimates plus geometry of the action space) as the key to understand the behavior of several physical systems, from the Celestial mechanics to microphysics.

Among the applications of the exponential estimates, we shall consider problems of adiabatic invariance for systems with one or two frequencies coming from molecular dynamics. We shall compare the traditional rigorous approach via canonical transformations, the heuristic approach of Jeans and of Landau–Teller, and its possible rigorous implementation via Lindstet series. An old conjecture of Boltzmann and Jeans, concerning the possible presence of very long equilibrium times in classical gases (the classical analog of "quantum freezing") will be reconsidered. Rigorous and heuristic results will be compared with numerical results, to test their level of optimality.

Among the applications of Nekhoroshev theorem, we shall study the fast rotations of the rigid body, which is a rather complete problem, including degeneracy and singularities. Other applications include the stability of elliptic equilibria, with special emphasis on the stability of triangular Lagrangian points in the spatial restricted three body problem.

References:

For a general introduction to the subject, one can look at chapter 5 of V.I. Arnold, VV. Kozlov and A.I. Neoshtadt, in *Dynamical Systems III,* V.I. Arnold Editor (Springer, Berlin 1988). An introduction to physical applications of Nekhorshev theorem and exponential estimates is in the proceeding of the Noto School "Non-Linear Evolution and Chaotic Phenomena", G. Gallavotti and P.W. Zweifel Editors (Plenum Press, New York, 1988), see the contributions by G. Benettin, L. Galgani and A. Giorgilli.

General references on Nekhoroshev theorem and exponential estimates: N.N. Nekhoroshev, Usp. Mat. Nauk. **32**:6, 5-66 (1977) [Russ. Math. Surv. **32**:6, 1-65

(1977)]; G. Benettin, L. Galgani, A. Giorgilli, Cel. Mech. **37**, 1 (1985); A. Giorgilli and L. Galgani, Cel. Mech. **37**, 95 (1985); G. Benettin and G. Gallavotti, Journ. Stat. Phys. **44**, 293-338 (1986); P. Lochak, Russ. Math. Surv. **47**, 57-133 (1992); J. Pöschel, Math. Z. **213**, 187–216 (1993).

Applications to statistical mechanics: G. Benettin, in: *Boltzmann's legacy 150 years afrer his birth*, Atti Accad. Nazionale dei Lincei **131**, 89-105 (1997); G. Benettin, A. Carati and P. Sempio, Journ. Stat. Phys. **73**, 175–192 (1993); G. Benettin, A. Carati and G. Gallavotti, Nonlinearity **10**, 479-505 (1997); G. Benettin, A. Carati e F. Fassò, Physica D **104**, 253-268 (1997); G. Benettin, P. Hjorth and P. Sempio, *Exponentially long equilibrium times in a one dimensional collisional model of a classical gas*, in print in Journ. Stat. Phys.

Applications to the rigid body: G. Benettin and F. Fassò, Nonlinearity **9**, 137-186 (1996); G. Benettin, F. Fassò e M. Guzzo, Nonlinearity **10**, 1695-1717 (1997).

Applications to elliptic equilibria (recent nonisochronous approach): F. Fassò, M. Guzzo e G. Benettin, Comm. Math. Phys. **197**, 347-360 (1998); L. Niederman, *Nonlinear stability around an elliptic equilibrium point in an Hamiltonian system*, preprint (1997). M. Guzzo, F. Fasso' e G. Benettin, Math. Phys. Electronic Journal, Vol. **4**, paper 1 (1998); G. Benettin, F. Fassò e M. Guzzo, *Nekhoroshev–stability of L4 and L5 in the spatial restricted three–body problem*, in print in Regular and Chaotic Dynamics.

b) KAM-theory (6 lectures in English)

Prof. Hakan ELIASSON (Royal Institute of Technology, Stockholm, Sweden)

Abstract

Quasi-periodic motions (or invariant tori) occur naturally when systems with periodic motions are coupled. The perturbation problem for these motions involves small divisors and the most natural way to handle this difficulty is by the quadratic convergence given by Newton's method. A basic problem is how to implement this method in a particular perturbative situation. We shall describe this difficulty, its relation to linear quasi-periodic systems and the way given by KAM-theory to overcome it in the most generic case. Additional difficulties occur for systems with elliptic lower dimensional tori and even more for systems with weak non-degeneracy.

We shall also discuss the difference between initial value and boundary value problems and their relation to the Lindstedt and the Poincaré-Lindstedt series.

The classical books Lectures in Celestial Mechanics by Siegel and Moser (Springer 1971) and Stable and Random Motions in Dynamical Systems by Moser (Princeton University Press 1973) are perhaps still the best introductions to KAM-theory. The development up to middle 80's is described by Bost in a Bourbaki Seminar (no. 6 1986). After middle 80's a lot of work have been devoted to elliptic lower dimensional tori, and to the study of systems with weak non-degeneracy starting with the work of Cheng and Sun (for example "*Existence of KAM-tori in Degenerate Hamiltonian systems*", J. Diff. Eq. 114, 1994). Also on linear quasi-periodic systems there has been some progress which is described in my article "*Reducibility and point spectrum for quasi-periodic skew-products*", Proceedings of the ICM, Berlin volume II 1998.

c) The Adiabatic Invariant in Classical Dynamics: Theory and applications (6 lectures in English).

Prof. Jacques HENRARD (Facultés Universitaires Notre Dame de la Paix, Namur, Belgique).

Abstract

The adiabatic invariant theory applies essentially to oscillating non-autonomous Hamiltonian systems when the time dependance is considerably slower than the oscillation periods. It describes "easy to compute" and "dynamicaly meaningful" quasi-invariants by which on can predict the approximate evolution of the system on very large time scales. The theory makes use and may serve as an illustration of several classical results of Hamiltonian theory.

1) Classical Adiabatic Invariant Theory (Including an introduction to angle-action variables)

2) Classical Adiabatic Invariant Theory (continued) and some applications (including an introduction to the "magnetic bottle")

3) Adiabatic Invariant and Separatrix Crossing (Neo-adiabatic theory)

4) Applications of Neo-Adiabatic Theory: Resonance Sweeping in the Solar System

5) The chaotic layer of the "Slowly Modulated Standard Map"

References:

J.R. Cary, D.F. Escande, J.L. Tennison: Phys.Rev. A, 34, 1986, 3256-4275

J. Henrard, in "*Dynamics reported*" (n=B02- newseries), Springer Verlag 1993; pp 117-235)

J. Henrard: in "*Les méthodes moderne de la mécanique céleste*" (Benest et Hroeschle eds), Edition Frontieres, 1990, 213-247

J. Henrard and A. Morbidelli: Physica D, 68, 1993, 187-200.

d) Some aspects of qualitative theory of Hamiltonian PDEs (6 lectures in English).

Prof. Sergei B. KUKSIN (Heriot-Watt University, Edinburgh, and Steklov Institute, Moscow)

Abstract.

I) Basic properties of Hamiltonian PDEs. Symplectic structures in scales of Hilbert spaces, the notion of a Hamiltonian PDE, properties of flow-maps, etc.

II) Around Gromov's non-squeezing property. Discussions of the finite-dimensional Gromov's theorem, its version for PDEs and its relevance for mathematical physics, infinite-dimensional symplectic capacities.

III) Damped Hamiltonian PDEs and the turbulence-limit. Here we establish some qualitative properties of PDEs of the form <non-linear Hamiltonian PDE>+<small linear damping> and discuss their relations with theory of decaying turbulence

Parts I)-II) will occupy the first three lectures, Part III - the last two.

References

[1] S.K., *Nearly Integrable Infinite-dimensional Hamiltonian Systems.* LNM 1556, Springer 1993.

[2] S.K., *Infinite-dimensional symplectic capacities and a squeezing theorem for Hamiltonian PDE's.* Comm. Math. Phys. 167 (1995), 531-552.

[3] Hofer H., Zehnder E., *Symplectic invariants and Hamiltonian dynamics.* Birkhauser, 1994.

[4] S.K. *Oscillations in space-periodic nonlinear Schroedinger equations.* Geometric and Functional Analysis 7 (1997), 338-363.

For I) see [1] (Part 1); for II) see [2,3]; for III) see [4]."

e) An overview on some problems in Celestial Mechanics (6 lectures in English)

Prof. Carles SIMO' (Universidad de Barcelona, Spagna)

Abstract

1. Introduction. The N-body problem. Relative equilibria. Collisions.

2. The 3D restricted three-body problem. Libration points and local stability analysis.

3. Periodic orbits and invariant tori. Numerical and symbolical computation.

4. Stability and practical stability. Central manifolds and the related stable/unstable manifolds. Practical confiners.

5. The motion of spacecrafts in the vicinity of the Earth-Moon system. Results for improved models. Results for full JPL models.

References:

C. Simò, *An overview of some problems in Celestial Mechanics*, available at http://www-ma1.upc.es/escorial .

Click of "curso completo" of Prof. Carles Simó

Applications

Deadline for application: **May 15, 1999.**

Applicants are requested to submit, along with their application, a scientific curriculum and a letter of recommendation.

CIME will be able to partially support some of the youngest participants. Those who plan to apply for support have to mention it explicitely in the application form.

Attendance

No registration fee is requested. Lectures will be held at Cetraro on July 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. Participants are requested to register on June 30, 1999.

Site and lodging

The session will be held at Grand Hotel S. Michele at Cetraro (Cosenza), Italy. Prices for full board (bed and meals) are roughly 150.000 italian liras p.p. day in a single room, 130.000 italian liras in a double room. Cheaper arrangements for multiple lodging in a residence are avalaible. More detailed information may be obtained from the Direction of the hotel (tel. +39-098291012, Fax +39-098291430, email: sanmichele@antares.it.

Further information on the hotel at the web page www.sanmichele.it

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FONDAZIONE C.I.M.E.
CENTRO INTERNAZIONALE MATEMATICO ESTIVO
INTERNATIONAL MATHEMATICAL SUMMER CENTER

"Global Theory of Minimal Surfaces in Flat Spaces"

is the subject of the fourth 1999 C.I.M.E. Session.

The session, sponsored by the Consiglio Nazionale delle Ricerche (C.N.R.), the Ministero dell'Università e della Ricerca Scientifica e Tecnologica (M.U.R.S.T.) and the European Community, will take place, under the scientific direction of Professor Gian Pietro PIROLA (Un. di Pavia), at Ducal Palace of Martina Franca (Taranto), from July 7 to July 15, 1999.

Courses

a) Asymptotic geometry of properly embedded minimal surfaces (6 lecture in English)

Prof. William H. MEEKS, III (Un. of Massachusetts, Amherst, USA).

Abstract:

In recent years great progress has been made in understanding the asymptotic geometry of properly embedded minimal surfaces. The first major result of this type was the solution of the generalized Nitsch conjecture by P. Collin, based on earlier work by Meeks and Rosenberg. It follows from the resolution of this conjecture that whenever M is a properly embedded minimal surface with more than one end and $E \subset M$ is an annular end representative, then E has finite total curvature and is asymptotic to an end of a plan or catenoid. Having finite total curvature in the case of an annular end is equivalent to proving the end has quadratic area growth with respect to the radial function r. Recently Collin, Kusner, Meeks and Rosenberg have been able to prove that any middle end of M, even one with infinite genus, has quadratic area growth. It follows from this result that middle ends are never limit ends and hence M can only have one or two limit ends which must be top or bottom ends. With more work it is shown that the middle ends of M stay a bounded distance from a plane or an end of a catenoid.

The goal of my lectures will be to introduce the audience to the concepts in the theory o f properly embedded minimal surfaces needed to understand the above results and to understand some recent classification theorems on proper minimal surfaces of genus 0 in flat three-manifolds.

References

1) H. Rosenberg, *Some recent developments in the theory of properly embedded minimal surfaces in E*, Asterisque **206**, (19929, pp. 463-535;

2) W. Meeks & H. Rosenberg, *The geometry and conformal type of properly embedded minimal surfaces in E*, Invent.Math. **114**, (1993), pp. 625-639;

3) W. Meeks, J. Perez & A. Ros, *Uniqueness of the Riemann minimal examples*, Invent. Math. **131**, (1998), pp. 107-132;

4) W. Meeks & H. Rosenberg, *The geometry of periodic minimal surfaces*, Comm. Math. Helv. **68**, (1993), pp. 255-270;

5) P. Collin, *Topologie et courbure des surfaces minimales proprement plongees dans E*, Annals of Math. **145**, (1997), pp. 1-31;

6) H. Rosenberg, *Minimal surfaces of finite type*, Bull. Soc. Math. France **123**, (1995), pp. 351-359;

7) Rodriquez & H. Rosenberg, *Minimal surfaces in E with one end and bounded curvature*, Manusc. Math. **96**, (1998), pp. 3-9.

b) Properly embedded minimal surfaces with finite total curvature (6 lectures in English)

Prof. Antonio ROS (Universidad de Granada, Spain)

Abstact:

Among properly embedded minimal surfaces in Euclidean 3-space, those that have finite total curvature form a natural and important subclass. These surfaces have finitely many ends which are all parallel and asymptotic to planes or catenoids. Although the structure of the space $\mathcal{M}$ of surfaces of this type which have a fixed topology is not well understood, we have a certain number of partial results and some of them will be explained in the lectures we will give.

The first nontrivial examples, other than the plane and the catenoid, were constructed only ten years ago by Costa, Hoffman and Meeks. Schoen showed that if the surface has two ends, then it must be a catenoid and López and Ros proved that the only surfaces of genus zero are the plane and the catenoid. These results give partial answers to an interesting open problem: decide which topologies are supported by this kind of surfaces. Ros obtained certain compactness properties of $\mathcal{M}$. In general this space is known to be noncompact but he showed that $\mathcal{M}$ is compact for some fixed topologies. Pérez and Ros studied the local structure of $\mathcal{M}$ around a nondegenerate surface and they proved that around these points the moduli space can be naturally viewed as a Lagrangian submanifold of the complex Euclidean space.

In spite of that analytic and algebraic methods compete to solve the main problems in this theory, at this moment we do not have a satisfactory idea of the behaviour of the moduli space $\mathcal{M}$. Thus the above is a good research field for young geometers interested in minimal surfaces.

References

1) C. Costa, *Example of a compete minimal immersion in* $\mathbb{R}^3$ *of genus one and three embedded ends,* Bull. SOc. Bras. Math. **15, (1984), pp. 47-54;**

2) D. Hoffman & H. Karcher, *Complete embedded minimal surfaces of finite total curvature*, R. Osserman ed., Encyclopedia of Math., vol. of Minimal Surfaces, **5-90**, Springer 1997;

3) D. Hoffman & W. H. Meeks III, *Embedded minimal surfaces of finite topology,* Ann. Math. **131**, (1990), pp. 1-34;

4) F. J. Lòpez & A. Ros, *On embedded minimal surfaces of genus zero*, J. Differential Geometry **33**, (1991), pp. 293-300;

5) J. P. Perez & A. Ros, *Some uniqueness and nonexistence theorems for embedded minimal surfaces*, Math. Ann. **295** (3), (1993), pp. 513-525;

6) J. P. Perez & A. Ros, *The space of properly embedded minimal surfaces with finite total curvature*, Indiana Univ. Math. J. **45** 1, (1996), pp.177-204.

c) Minimal surfaces of finite topology properly embedded in E (Euclidean 3-space).(6 lectures in English)

Prof. Harold ROSENBERG (Univ. Paris VII, Paris, France)

Abstract:

We will prove that a properly embedded minimal surface in E of finite topology and at least two ends has finite total curvature. To establish this we first prove that each annular end of such a surface M can be made transverse to the horizontal planes

(after a possible rotation in space), [Meeks-Rosenberg]. Then we will prove that such an end has finite total curvature [Pascal Collin]. We next study properly embedded minimal surfaces in E with finite topology and one end. The basic unsolved problem is to determine if such a surface is a plane or helicoid when simply connected. We will describe partial results. We will prove that a properly immersed minimal surface of finite topology that meets some plane in a finite number of connected components, with at most a finite number of singularities, is of finite conformal type. If in addition the curvature is bounded, then the surface is of finite type. This means M can be parametrized by meromorphic data on a compact Riemann surface. In particular, under the above hypothesis, M is a plane or helicoid when M is also simply connected and embedded. This is work of Rodriquez- Rosenberg, and Xavier. If time permits we will discuss the geometry and topology of constant mean curvature surfaces properly embedded in E.

References

1) H. Rosenberg, *Some recent developments in the theory of properly embedded minimal surfaces in E*, Asterique **206**, (1992), pp. 463-535;

2) W.Meeks & H. Rosenberg, *The geometry and conformal type of properly embedded minimal surfaces in E*, Invent. **114**, (1993), pp.625-639;

3) P. Collin, *Topologie et courbure des surfaces minimales proprement plongées dans E*, Annals of Math. **145**, (1997), pp. 1-31

4) H. Rosenberg, *Minimal surfaces of finite type*, Bull. Soc. Math. France **123**, (1995), pp. 351-359;

5) Rodriquez & H. Rosenberg, *Minimal surfaces in E with one end and bounded curvature*, Manusc. Math. **96**, (1998), pp. 3-9.

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hosted. Martina Franca is part of the province of Taranto, one of the major centres of Magna Grecia, particularly devoted to mathematics. Taranto houses an outstanding museum of Magna Grecia with fabulous collections of gold manufactures.

Lecture Notes

Lecture notes will be published as soon as possible after the Session.

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FONDAZIONE C.I.M.E.
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INTERNATIONAL MATHEMATICAL SUMMER CENTER

"Direct and Inverse Methods in Solving Nonlinear Evolution Equations"

is the subject of the fifth 1999 C.I.M.E. Session.

The session, sponsored by the Consiglio Nazionale delle Ricerche (C.N.R.), the Ministero dell'Università e della Ricerca Scientifica e Tecnologica (M.U.R.S.T.) and the European Community, will take place, under the scientific direction of Professor Antonio M. Greco (Università di Palermo), at Grand Hotel San Michele,Cetraro (Cosenza), from September 8 to September 15, 1999.

a) Exact solutions of nonlinear PDEs by singularity analysis (6 lectures in English)

Prof. Robert CONTE (Service de physique de l'état condensé, CEA Saclay, Gif-sur-Yvette Cedex, France)

Abstract

1) Criteria of integrability : Lax pair, Darboux and Bäcklund transformations. Partial integrability, examples. Importance of involutions.

2) The Painlevé test for PDEs in its invariant version.

3) The "truncation method" as a Darboux transformation, ODE and PDE situations.

4) The one-family truncation method (WTC), integrable (Korteweg-de Vries, Boussinesq, Hirota-Satsuma, Sawada-Kotera) and partially integrable (Kuramoto-Sivashinsky) cases.

5) The two-family truncation method, integrable (sine-Gordon, mKdV, Broer-Kaup) and partially integrable (complex Ginzburg-Landau and degeneracies) cases.

6) The one-family truncation method based on the scattering problems of Gambier: BT of Kaup-Kupershmidt and Tzitzéica equations.

References

References are divided into three subsets: prerequisite (assumed known by the attendant to the school), general (not assumed known, pedagogical texts which would greatly benefit the attendant if they were read before the school), research (research papers whose content will be exposed from a synthetic point of view during the course).

Prerequisite bibliography.

The following subjects will be assumed to be known : the Painlevé property for nonlinear ordinary differential equations, and the associated Painlevé test.

Prerequisite recommended texts treating these subjects are

[P.1] E. Hille, *Ordinary differential equations in the complex domain* (J. Wiley and sons, New York, 1976).

[P.2] R. Conte, *The Painlevé approach to nonlinear ordinary differential equations, The Painlevé property, one century later*, 112 pages, ed. R. Conte, CRM series in mathematical physics (Springer, Berlin, 1999). Solv-int/9710020.

The interested reader can find many applications in the following review, which should not be read before [P.2] :

[P.3] A. Ramani, B. Grammaticos, and T. Bountis, *The Painlevé property and singularity analysis of integrable and nonintegrable systems*, Physics Reports 180 (1989) 159–245.

A text to be avoided by the beginner is Ince's book, the ideas are much clearer in Hille's book.

There exist very few pedagogical texts on the subject of this school.

A general reference, covering all the above program, is the course delivered at a Cargèse school in 1996 :

[G.1] M. Musette, *Painlevé analysis for nonlinear partial differential equations, The Painlevé property, one century later*, 65 pages, ed. R. Conte, CRM series in mathematical physics (Springer, Berlin, 1999). Solv-int/9804003.

A short subset of [G.1], with emphasis on the ideas, is the conference report

[G.2] R. Conte, *Various truncations in Painlevé analysis of partial differential equations*, 16 pages, Nonlinear dynamics : integrability and chaos, ed. M. Daniel, to appear (Springer? World Scientific?). Solv-int/9812008. Preprint S98/047.

Research papers.

[R.2] J.? Weiss, M. Tabor and G. Carnevale, *The Painlevé property for partial differential equations*, J. Math. Phys. 24 (1983) 522–526.

[R.3] Numerous articles of Weiss, from 1983 to 1989, all in J. Math. Phys. [singular manifold method].

[R.4] M. Musette and R. Conte, *Algorithmic method for deriving Lax pairs from the invariant Painlevé analysis of nonlinear partial differential equations*, J. Math. Phys. 32 (1991) 1450–1457 [invariant singular manifold method].

[R.5] R. Conte and M. Musette, *Linearity inside nonlinearity: exact solutions to the complex Ginz-burg-Landau equation*, Physica D 69 (1993) 1–17 [Ginzburg-Landau].

[R.6] M. Musette and R. Conte, *The two-singular manifold method, I. Modified KdV and sine-Gordon equations*, J. Phys. A 27 (1994) 3895–3913 [Two–singular manifold method].

[R.7] R. Conte, M. Musette and A. Pickering, *The two-singular manifold method, II.* Classical Boussinesq system, J. Phys. A 28 (1995) 179–185 [Two–singular manifold method].

[R.8] A. Pickering, *The singular manifold method revisited*, J. Math. Phys. 37 (1996) 1894–1927 [Two–singular manifold method].

[R.9] M. Musette and R. Conte, *Bäcklund transformation of partial differential equations from the Painlevé-Gambier classification, I. Kaup-Kupershmidt equation*, J. Math. Phys. 39 (1998) 5617–5630. [Lecture 6].

[R.10] R. Conte, M. Musette and A. M. Grundland, *Bäcklund transformation of partial differential equations from the Painlevé-Gambier classification, II. Tzitzéica equation*, J. Math. Phys. 40 (1999) to appear. [Lecture 6].

b) Integrable Systems and Bi-Hamiltonian Manifolds (6 lectures in English)

Prof. Franco MAGRI (Università di Milano, Milano, Italy)

Abstract

1) Integrable systems and bi-hamiltonian manifolds according to Gelfand and Zakharevich.

2) Examples: KdV, KP and Sato's equations.

3) The rational solutions of KP equation.
4) Bi-hamiltonian reductions and completely algebraically integrable systems.
5) Connections with the separabilty theory.
6) The τ function and the Hirota's identities from a bi-hamiltonian point of view.

References

1) R. Abraham, J.E. Marsden, *Foundations of Mechanics*,Benjamin/Cummings, 1978

2) P. Libermann, C. M. Marle, *Symplectic Geometry and Analytical Mechanics*, Reidel Dordrecht, 1987

3) L. A. Dickey, *Soliton Equations and Hamiltonian Systems*, World Scientific, Singapore, 1991, Adv. Series in Math. Phys Vol. 12

4) I. Vaisman, *Lectures on the Geometry of Poisson Manifolds*, Progress in Math., Birkhäuser, 1994

5) P. Casati, G. Falqui, F. Magri, M. Pedroni (1996), *The KP theory revisited. I,II,III,IV.* Technical Reports, SISSA/2,3,4,5/96/FM, SISSA/ISAS, Trieste, 1995

c) Hirota Methods for non Linear Differential and Difference Equations (6 lectures in English)

Prof. Junkichi SATSUMA (University of Tokyo, Tokyo, Japan)

Abstract

1) Introduction;
2) Nonlinear differential systems;
3) Nonlinear differential-difference systems;
4) Nonlinear difference systems;
5) Sato theory;
6) Ultra-discrete systems.

References.

1) M.J.Ablowitz and H.Segur, *Solitons and the Inverse Scattering Transform*, (SIAM, Philadelphia, 1981).

2) Y.Ohta, J.Satsuma, D.Takahashi and T.Tokihiro, " Prog. Theor. Phys. Suppl. No.94, p.210-241 (1988)

3) J.Satsuma, *Bilinear Formalism in Soliton Theory*, Lecture Notes in Physics No.495, Integrability of Nonlinear Systems, ed. by Y.Kosmann-Schwarzbach, B.Grammaticos and K.M.Tamizhmani p.297-313 (Springer, Berlin, 1997).

d) Lie Groups and Exact Solutions of non Linear Differential and Difference Equations (6 lectures in English)

Prof. Pavel WINTERNITZ (Universitè de Montreal, Montreal, Canada) 3J7

Abstract

1) Algorithms for calculating the symmetry group of a system of ordinary or partial differential equations. Examples of equations with finite and infinite Lie point symmetry groups;

2) Applications of symmetries. The method of symmetry reduction for partial differential equations. Group classification of differential equations;

3) Classification and identification of Lie algebras given by their structure constants. Classification of subalgebras of Lie algebras. Examples and applications;

4) Solutions of ordinary differential equations. Lowering the order of the equation. First integrals. Painlevè analysis and the singularity structure of solutions;

5) Conditional symmetries. Partially invariant solutions.

6) Lie symmetries of difference equations.

References.

1) P. J. Olver, *Applications of Lie Groups to Differential Equations*, Springer,1993,

2) P. Winternitz, *Group Theory and Exact Solutions of Partially Integrable Differential Systems*, in Partially Integrable Evolution Equations in Physics, Kluwer, Dordrecht, 1990, (Editors R.Conte and N.Boccara).

3) P. Winternitz, in "*Integrable Systems, Quantum Groups and Quantum Field Theories*", Kluwer, 1993 (Editors L .A. Ibort and M. A. Rodriguez).

Applications

Those who want to attend the Session should fill in an application to the C.I.M.E Foundation at the address below, **not later than May 30**, 1999.

An important consideration in the acceptance of applications is the scientific relevance of the Session to the field of interest of the applicant.

Applicants are requested, therefore, to submit, along with their application, a scientific curriculum and a letter of recommendation.

Participation will only be allowed to persons who have applied in due time and have had their application accepted.

CIME will be able to partially support some of the youngest participants. Those who plan to apply for support have to mention it explicitely in the application form.

Attendance

No registration fee is requested. Lectures will be held at Cetraro on September 8, 9, 10, 11, 12, 13, 14, 15. Participants are requested to register on September 7, 1999.

Site and lodging

The session will be held at Grand Hotel S. Michele at Cetraro (Cosenza), Italy. Prices for full board (bed and meals) are roughly 150.000 italian liras p.p. day in a single room, 130.000 italian liras in a double room. Cheaper arrangements for multiple lodging in a residence are avalaible. More detailed informations may be obtained from the Direction of the hotel (tel. +39-098291012, Fax +39-098291430, email: sanmichele@antares.it.

Further information on the hotel at the web page www.sanmichele.it

Lecture Notes

Lecture notes will be published as soon as possible after the Session.

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CIME Secretary

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