Programa de Pós Graduação em Matemática IM-UFRJ
Ementas para a Previsão de Turmas 2017-2

MAA835 Tópicos Especiais da Teoria de Anéis
(Grupos analíticos p-ádicos compactos e seus anéis e álgebras associados)
Professor Ilir Snopche

Compact p-adic analytic groups and their associated rings and algebras

Profinite groups are inverse limits of inverse systems of finite groups. They were introduced in Number Theory early in the last century, the additive group of the ring of p-adic integers being the first example of a profinite group. Profinite groups of greater complexity were introduced by Krull, who realized that the Galois group of an infinite Galois extension of fields is in a natural way a profinite group. Indeed, profinite groups are precisely Galois groups and many of the applications of profinite groups are related to Number Theory. On the other hand, one can define profinite groups as Hausdorff, compact and totally disconnected topological groups; thus they have strong connections with Topology. Grothendieck introduced profinite groups into Algebraic Geometry as étale fundamental groups of schemes. Moreover, recently it was shown that profinite groups play an important role in Geometry.

A very important class of profinite groups is the class of compact p-adic analytic groups. These groups have a manifold structure over the field of p-adic integers. Thus, one can consider these groups simultaneously as profinite and Lie groups. Besides in algebra, p-adic analytic groups play an important role in Algebraic Number Theory, Geometry, Analysis and Model Theory.

The aim of this course is to develop the basic theory of p-adic analytic groups and to study the structure of the associated rings and algebras. In particular, we will study the completed algebras and the graded Lie rings associated to p-adic analytic groups. Moreover, we will see some applications of this theory in other areas of mathematics.

Prerequisites: Basic Group Theory, Basic Ring Theory and Topology

The following topics would be covered:

- Topological groups and rings

- Inverse limits

- Definition of a profinite group (ring)
  - A profinite group as the inverse limit of an inverse system of finite groups (rings)
  - A profinite group as a Hausdorff, compact and totally disconnected topological group
- The ring of p-adic integers and the Prüfer ring

- Finitely generated pro-p groups
  - Finitely generated groups and finite images
  - Finitely generated groups and subgroups of finite index

- p-adic analytic groups and associated rings (algebras): algebraic approach
  - Powerful finite p-groups
  - Powerful pro-p groups
  - Uniform groups
  - The associated Lie ring (algebra)

- Normed algebras
  - Normed rings
  - Strictly analytic functions
  - The Campbell-Hausdorff formula

    - Power series over pro-p rings

- The group algebra
    - The norm
    - The Lie algebra
    - Linear representations
    - The completed group algebra

- p-adic analytic groups and associated rings (algebras): analytic approach
    - p-adic analytic manifolds
    - p-adic analytic groups
    - Uniform pro-p groups
    - Serre's standard groups

- Lie theory
    - Powerful Lie algebras
    - Analytic groups and their Lie algebras

- Some graded Lie algebras
    - Restricted and graded Lie algebras
    - Theorems of Jennings and Lazard

- Applications in other areas of mathematics

Bibliography

[1] J. D. Dixon, M. P. F. du Sautoy, A. Mann & D. Segal, *Analytic pro- p Groups*, 2nd edition, Cambridge Studies in Advanced Maths. 61, Cambridge Univ. Press, Cambridge, 1999.

[2] L. Ribes and P. A. Zalesskii, *Profinite Groups*. Second edition. Springer-Verlag, Berlin , 2010.

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MAC865-Aspectos Recentes em EDP II

Prof. Jaime Rivera

A ementa:
1) A algebra dos operadores lineares e contínuos, ideiais maximais.
2) Algebra de Calkin. O espectro essencial Raio espectral essencial
3) Espectro Residual, Continuo y Discreto
4) Extensões do Teorema de Weyl.
5) Aplicações a Teoria de semigrupos. Tipo essencial. Caracterizacao do Tipo de um semigrupo
6) Aplicações para Ecuações hiperbólicas de primeira ordem
7) Aplicacoes para equações não autónomas. Teoria de operadores aplicada às EDP
8) Familia de operadores resolventes.
9) Cálculo do Tipo essencial. Exemplos e aplicações.

Referências

[1]T. Kato; Perturbation Theory for Linear Operators, {Springer-Verlag Berlin Heidelberg New York (1980)}.

[2] Henry, Daniel B. and Perissinitto, Jr., Anisio and Lopes; On the essential spectrum of a semigroup of thermoelasticity, { Nonlinear Anal. Vol. 21, (1), pages 65- 75, (1993)}. doi:10.1016/0362-546X(93)90178-U

[3] J. Pruss; On the spectrum of C_0-semigroups, { Transactions of the American Mathematical Society Vol. 284, (2), pages 847-857, (1984)}.

[4] K.-J., Engel, R., Nagel. { One parameter Semigroups for Linear Evolution Equations.} Springer (1991).

[5] A. F. Neves, H.S. Ribeiro, O. Lopes; On the spectrum of evolution operators generated by hyperbolic systems, {Journal of Functional Analysis Vol. 67, (1), pages

320- 344, (1986)}.

[6] M. Renardy; On the type of certain C_0-semigroups, {Communications in Partial Differential Equations Vol. 18, (7-8), pages 1299-1307, (1993)}.

[7] Jurgen Voigt; A Perturbation Theorem for the Essential Spectral Radius of Strongly Continuous Sem, {Monatshefte fur Mathematik Vol. 90, (2), pages 153- 161, (1980)}.

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MAC854-Tópicos Especiais em Sistemas Dinâmicos I (Measurable dynamics) – Prof. Carlos Morales

Ementa:

1.-Discrete and continuous dynamical systems. Group actions.

2.-Basic notions: Periodic Points, Omega-limit set, Nonwandering set, Spectral decompositions.

3.- Equicontinuous systems and equicontinuous measures. Ellis semigroup.

4.- Distal systems, N-distal systems, countably-distality. Furstenberg structure theorem for distal systems. Distal points for Borel measures. Distal and almosty distal measures. N-distality for Borel measures.

5.- Expansive systems. N-expansive systems and CW-expansive systems. Expansive measures, strong measure-expansivity (by Cordeiro-Denker-Zhang), N-expansive systems with the POTP (Carvalho-Cordeiro example). N-expansive measures, CW-expansive measures, Levels of expansivity for homeomorphisms and measures. Meagre-expansivity for homoemorphisms and measures.

6.- Topological stability. N-topological stability. Walters stability theorem. N-expansive systems with the POTP. Topologically stable measures. Topologically stable points.

7.-Shadowable systems and points. Shadowable measures.

8.-Basics on Gromov-Hausdorff metric, Gromov-Hausdorff distance for maps, topological stability from Gromov-Hausdorff viewpoint.

References.

1.-Morales,, C.A., Measurable Dynamics, in preparation.

2.-Lee, K., Morales, C.A., Shin, B., Levels of expansivity for Borel measures, Preprint 2017.

3.-Lee, K., Morales, C.A., Shin, B., CW-expansivity for Borel measures, in preparation.

4.-Morales, C.A., Villavicencio, H., Meagre expansivity, in preparation.

5.- Cordeiro, W., Denker, M., Zhang, X., On specification and measure expansiveness, Discrete Contin. Dyn. Syst. 37 (2017), no. 4, 1941–1957.

6.-Morales, C.A., Sirvent, V., Expansive measures, Colloquio Brasileiro de Matematicas.

7.-Lee, K., Morales, C.A., Topological stability and pseudo-orbit tracing property for expansive measures, JDE 2017.

8.-Koo, N., Lee, K., Morales, C.A., Pointwise topological stability, Preprint 2017.

9.-Lee, K., Morales, C.A., Measures with the pseudo orbit tracing property and shadowable points, Preprint 2017.

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MAA856-Tópicos Especiais em Geometria Diferencial (Tópicos em Geometria Simplética) – Prof. Leonardo Macarini

Ementa:
A conjectura de Arnold e homologia de Floer. O funcional de ação e seu gradiente: a equação de Floer.
Energia de soluções da equação de Floer.
Compacidade do espaço de soluções com energia finita.
A topologia do grupo de transformações simpléticas lineares e o índice de Conley-Zehnder.
Linearização da equação de Floer e transversalidade.
Trajetórias de Floer são somewhere injective. A propriedade de Fredholm.
Cálculo do índice de Fredholm em termos dos índices de Conley-Zehnder.
O espaço de trajetórias de Floer: trajetórias quebradas e gluing.
Invariância da homologia de Floer.
Cálculo da homologia de Floer para Hamiltonianas autônomas C^2-pequenas e o isomorfismo entre a homologia de Floer e a homologia singular da variedade simplética.

Bibliografia:
- M. Audin e M. Damian, “Morse theory and Floer homology”. Translated from the 2010 French original by Reinie Erné. Universitext. Springer, London; EDP Sciences, Les Ulis, 2014.
- D. Salamon, “Lectures on Floer homology”. Symplectic geometry and topology (Park City, UT, 1997), 143–229, IAS/Park City Math. Ser., 7, Amer. Math. Soc., Providence, RI, 1999.