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Filippo Calderoni, ***A Descriptive View of the Bi-embeddability Relation***, Università degli Studi di Torino, Italy, 2018. Supervised by Luca Motto Ros. MSC: 03E15. Keywords: bi-embeddability, analytic equivalence relations, Borel reducibility, torsion-free abelian groups.

Abstract

In this thesis we use methods from the theory of Borel reducibility to analyze the bi-embeddability relation.

We continue the work of Camerlo, Marcone, and Motto Ros investigating the notion of invariant universality, which is a strengthening of the notion of completeness for analytic equivalence relations. We prove invariant universality for the following relations: bi-embeddability between countable groups, topological bi-embeddability between Polish groups, bi-embeddability between countable quandles, and bi-embeddability between countable fields of a fixed characteristic different from 2. Our work strengthens some results previously obtained by Jay Williams; Ferenczi, Louveau, and Rosendal; and Fried and Kollár.

Then, we analyze the bi-embeddability relation in the case of countable torsion-free abelian groups, and countable torsion abelian groups. We obtain that the bi-embeddability relation on torsion-free abelian groups is strictly more complicated than the bi-embeddability relation on torsion abelian groups. In fact, we prove that the former is a complete analytic equivalence relation, while the latter is incomparable up to Borel reducibility with the isomorphism relation on torsion groups. Furthermore, we argue that the bi-embeddability relation between countable torsion abelian groups is strictly below isomorphism up to $\mathbf{\Delta}^1_2$-reducibility.

In the end, we analyze the bi-embeddability relation on torsion-free abelian groups in the framework of generalized descriptive set theory. We use a categorical construction to prove that bi-embeddability on κ-sized graphs Borel reduces to bi-embeddability on torsion-free abelian groups of size κ, for every uncountable cardinal κ which satisfies $\kappa^{<\kappa} = \kappa$. It follows that the bi-embeddability relation on torsion-free abelian groups of size κ is as complicated as possible among analytic equivalence relations.

Abstract prepared by Filippo Calderoni
E-mail: filippo.calderoni@unito.it

Raphaël Carroy, ***Functions of the first Baire class***, Université Paris 7 - Denis Diderot & Université de Lausanne, France, 2013. Supervised by Olivier Finkel & Jacques Duparc. MSC: Primary 26A21, 54C05. Keywords: Continuous functions, infinite games, well-quasi-orders, continuous reducibility.

Abstract

We aim at starting an analysis of definable functions similar to the Wadge theory for definable sets, focusing more specifically on Baire class 1 functions between 0-dimensional Polish spaces. To parallel Wadge's analysis, we break this study in two parts. The first concerns subclasses of the first Baire class characterisable by infinite games, while the second looks at the quasi-order of continuous reducibility on continuous functions.

Here X, Y, X', and Y' are variables for Polish 0-dimensional (P0D for short) spaces, considered as closed subspaces of the Baire space of infinite sequences of natural numbers.

https://doi.org/10.1017/bsl.2018.82 Published online by Cambridge University Press