

Boletín del IMI, Nº 87 (27 de abril de 2023) <https://doi.org/10.57037/b-imi.00087>

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1) A Message from the IMI Director

Dear Colleagues,

It is a pleasure to announce that we are starting a new section of the *Boletín del IMI*, called "Math puzzle". In this section we will publish mathematical puzzles whose solution will be given in later issues. In addition, it is also a pleasure to introduce you to a new contributor to the *Boletín del IMI*, who sends the puzzle that inaugurates this section. He is Kjartan Poskitt, a British writer who is best known for writing the *Murderous Maths* series of books, which have sold over 10,000,000 copies around the world in 30 languages. He has also written books on Isaac Newton and Houdini plus books on magic, mazes, puzzles, children's novels and stage musicals. He presents maths shows both on stage and tv, and plays piano in pubs.



Kjartan Poskitt

I hope you enjoy his puzzles.
Thanks a lot Kjartan!

Ángel Manuel Ramos del Olmo

2) Activities from April 27th to May 5th, 2023

Seminario de Análisis Matemático y Matemática Aplicada

Title: Approximation of mappings with derivatives of low rank

Speaker: Piotr Hajłasz (University of Pittsburgh)

Day: 27th of April, 2023

Hour: 13:00h

Place: Seminario Alberto Dou (Room 209), Facultad de CC Matemáticas, UCM

Organized by: Instituto de Matemática Interdisciplinar (IMI) and Departamento de Análisis Matemático y Matemática Aplicada

DEPARTAMENTO DE ANÁLISIS MATEMÁTICO Y MATEMÁTICA APLICADA
Facultad de Ciencias MATEMÁTICAS
UNIVERSIDAD COMPLUTENSE DE MADRID

SEMINARIO DE ANÁLISIS MATEMÁTICO Y MATEMÁTICA APLICADA

Piotr Hajłasz
University of Pittsburgh

Approximation of mappings with derivatives of low rank

My talk is based on two recent joint papers with Peter I. Goldstein, Jacki Csörös (2017), in the context of his research in geometric measure theory, formalized the following conjecture: Conjecture: Let $f: \mathbb{R}^n \rightarrow \mathbb{R}^m$ be a mapping and let $Df(x)$ be the space of $n \times m$ matrices with rank $\leq m$ everywhere in \mathbb{R}^n , then f can be uniformly approximated by smooth mappings $g: \mathbb{R}^n \rightarrow \mathbb{R}^m$ such that rank $Dg \leq m$ everywhere in \mathbb{R}^n . One can also modify the conjecture and ask about a local approximation inside approximation in a neighborhood of any point. These are very natural problems with possible applications to PDEs and Calculus of Variations. However, the problems are difficult, because standard approximation techniques like the one based on convolution do not preserve the rank of the derivative. It is a highly nonlinear constraint, difficult to deal with. In 2018 Goldstein and Hajłasz obtained affirmatively every counterexample to this conjecture. Here is one example. There is $f: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ with rank $Df \leq 1$ that cannot be locally and uniformly approximated by mappings $g: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ satisfying rank $Dg \leq 1$. This example is a special case of a much more general result and the construction heavily depends on algebraic topology including the homotopy groups of spheres and the Fredholm suspension theorem. More recently Goldstein and Hajłasz proved the conjecture in the positive in the case when $n = 1$. The proof is based this time on methods of analysis on metric spaces and is particular on factorization of a mapping through metric trees. The method of factorization through metric trees was used in the proof of the conjecture when $n = 1$ is very different and completely unrelated to the methods of algebraic topology used in the construction of counterexamples. However, quite surprisingly, both techniques have originally been used by Wenger and Young as tools for study of Lipschitz homotopy groups of the Heisenberg group, a problem that seems completely unrelated to problems discussed in this talk.

Organized by: Departamento de Análisis Matemático y Matemática Aplicada and Instituto de Matemática Interdisciplinar (IMI)

Date: Thursday, April 27, 2023, 13:00 h.
Place: Room 209 (Seminario Alberto Dou),
Facultad de CC. Matemáticas, UCM

Seminario de Análisis Matemático y Matemática Aplicada

Title: Homogenization of linear kinetic equations with highly oscillating scattering terms

Speaker: Francesco Salvarani (Università di Pavia)

Day: 3th of May, 2023

Hour: 15:30h

Place: Room 209 (Seminario Alberto Dou), Facultad de CC Matemáticas, UCM

Organized by: Departamento de Análisis Matemático y Matemática Aplicada, Instituto de Matemática Interdisciplinar (IMI) and CADEDIF Research Group

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SEMINARIO DE ANÁLISIS MATEMÁTICO Y MATEMÁTICA APLICADA

Francesco Salvarani
Università di Pavia

Homogenization of linear kinetic equations with highly oscillating scattering terms

Abstract

This talk is devoted to the study of the homogenization problem for the linear Boltzmann equation in energy. Two approaches are considered. The first one is based on the two-scale convergence theory, which allows to prove the existence of a memory term in the structure of the homogenized equation. Because of this term, the semigroup property of the starting problem is lost in the limit. However, the semigroup structure of the limit equation can be preserved by working in a new framework based on an extended phase-space.

Organized by: Departamento de Análisis Matemático y Matemática Aplicada, Instituto de Matemática Interdisciplinar (IMI) y el grupo de Investigación CADEDIF.

Date: Wednesday, May 3, 2023, 15:30h
Place: Room 209 (Seminario Alberto Dou)
Facultad de CC. Matemáticas, UCM

Seminario de Análisis Matemático y Matemática Aplicada

Título: La familia de los espacios de Orlicz

Conferenciante: César Ruiz (Universidad Complutense de Madrid)

Día: 4 de mayo, 2023

Hora: 13:00h

Lugar: Aula B 03, Facultad de CC Matemáticas, UCM

Organizado por: Instituto de Matemática Interdisciplinar (IMI) y el Departamento de Análisis Matemático y Matemática Aplicada

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SEMINARIO DE ANÁLISIS MATEMÁTICO Y MATEMÁTICA APLICADA

César Ruiz
UCM

La familia de los espacios de Orlicz

La familia de los espacios de Orlicz contiene uno de los espacios de Banach más importantes de la teoría de la medida, el espacio de Lebesgue. En esta charla seguiremos los caminos abiertos por Pitt en el conocimiento de este espacio. Algunos hechos notables sobre estos espacios. Hablaremos de sus técnicas de ataque como de un campo de batalla. Pretendemos demostrar que nuestro protagonista protagonista de hoy no tiene un PH básico ni mucho menos árido muy agradable.

Organizado por el Departamento de Análisis Matemático y Matemática Aplicada y el Instituto de Matemática Interdisciplinar (IMI)

Fecha: Jueves 4 de mayo de 2023
a las 13:00 horas
Lugar: Aula B 03
Facultad de CC Matemáticas, UCM

3) New publications

J. Castro, **L.F. Escudero**, J.F. Monge. On solving large-scale multistage stochastic optimization problems with a new specialized interior-point approach. *European Journal of Operational Research*, 2023, doi.org/10.1016/j.ejor.2023.03.042.

I. Barbeito, D. Precioso, M. J. Sierra, S. V. Azcárate, S. F. Balbuena, **B. Vitoriano**, D. G. Ullate, R. Cao, S. Monge and the Study Group for Non-Pharmaceutical Interventions in Spain. Effectiveness of non-pharmaceutical interventions in nine fields of activity to decrease SARS-CoV-2 transmission (Spain, September 2020-May 2021). *Frontiers in Public Health, Sec. Infectious Diseases: Epidemiology and Prevention*. 2023, 11. <https://doi.org/10.3389/fpubh.2023.1061331>

4) La viñeta matemática

Viñeta enviada por Ángel Manuel Ramos, Director del IMI y creador de "Calista".



5) Math Puzzle

Puzzle sent by Kjartan Poskitt

The solution will be provided in the next issue of *Boletín del IMI*.



K-PUZZ

Fill the empty squares
with these numbers:


1 2 3 4

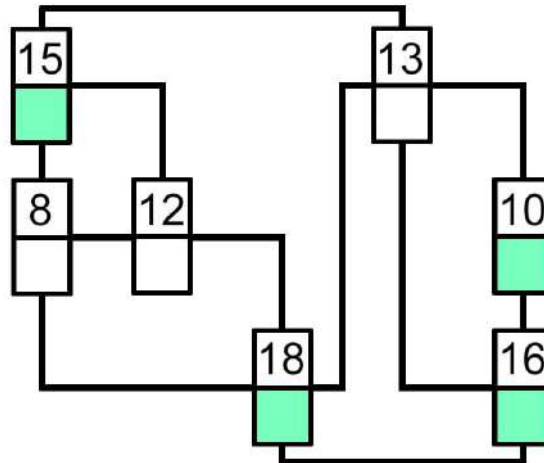
5 6 7

The number at the top of
each box equals the total of
the answers in the bottom
of the boxes linked to it.

For example: in this puzzle
the answers in the shaded
squares should add to 13.

EASY  HARD

 @murderousmaths



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