SEMINAR

Grupo de Análise Funcional e Aplicações
Functional Analysis and Applications Group

Existence results for the parabolic $p(x,t)$ and $p(u)$-Laplacian problems

Hermenegildo Borges de Oliveira
Universidade do Algarve

Abstract

Variational problems involving integrands with variable exponents of nonlinearity were introduced at the beginning of 1980's by Zhikov, but functionals with variable exponents were already used, in the context of Functional Analysis, by several authors such as Orlicz, Musielak and Rákosník, among others. However, it was only with the advent of the application of this theory in the mathematical modeling of complex real-world phenomena that this area had a great boost. By that time, problems with variable exponents were already used in engineering applications to model a large class of smart fluids. A more recent application is the image processing where the variable exponent is used to underline the borders of the distorted image and to eliminate the noise. In this seminar, we will take a look at the results of Fan and Zhang in the early 2000s on the existence, uniqueness and regularity for the elliptic $p(x)$-Laplacian problem. We continue with the results of Chipot and Oliveira around 2020 on the existence for the elliptic $p(u)$-Laplacian problem. Then we will address the results proved by Alkhutov and Zhikov and by Diening, Nägele and Růžička in the early 2010s on the existence for the parabolic $p(x,t)$-Laplacian problem. Regarding this problem, we will show a recent result by Bae, Oliveira and Wolf, in which we prove the existence of weak solutions under weaker assumptions on the continuity and boundedness of the nonlinearity exponent p. If time permits, we will make a short digression on open problems, especially for the $p(u)$-Laplacian.

Room 11.2.21
May 29, 2025 - 11:00