# SEMINÁRIO DE ANÁLISE E EQUAÇÕES DIFERENCIAIS

## <u>Dia 20 de Dezembro (quinta-feira)</u>, às <u>13h30</u>, na sala 6.2.33

# Fractional PDEs:
# Control, Applications, and Beyond

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Abstract:
Fractional calculus and its application to anomalous transport has recently received a tremendous amount of attention. In these studies, the anomalous transport (of charge, tracers, fluid, etc.) is presumed attributable to long-range correlations of material properties within an inherently complex, and in some cases self-similar, conducting medium. Rather than considering an exquisitely discretized (and computationally explosive) representation of the medium, the complex and spatially correlated heterogeneity is represented through reformulation of the PDE governing the relevant transport physics such that its coefficients are, instead, smooth but paired with fractional-order space derivatives.

This talk will give an introduction to fractional diffusion. We will describe how to incorporate nonhomogeneous boundary conditions in fractional PDEs. We will cover from linear to quasilinear fractional PDEs and fractional elliptic variational inequalities. Several optimal control strategies will be discussed, including optimization under uncertainty. We will conclude the talk with a new approach that allows the fractional exponent to be spatially dependent. This has enabled us to define novel Sobolev spaces and their trace spaces. Numerical evidence suggests that such spaces are useful in image processing.

Local: FCUL, C6 - Piso 2, 6.2.33

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