2019 CHAPTER

ICMC SUMMER MEETING
ON DIFFERENTIAL EQUATIONS

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SESSIONS:

- Boundary Perturbations of Domains for PDEs and Applications
- Computational Dynamics in the Context of Data
- Dispersive Equations
- Elliptic Equations
- Evolution Equations and Applications
- Fluid Dynamics
- Linear Equations
- Nonlinear Dynamical Systems
- Ordinary/Functional Differential Equations
- Poster Session

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The p-Laplacian equation in thin domains: the unfolding approach

Jean Carlos Nakasato, Marcone Corrêa Pereira, Jose M. Arrieta
Universidade de São Paulo, Brazil

In this work we apply the unfolding operator method to analyze the asymptotic behavior of the solutions of the p-Laplacian equation with Neumann boundary condition set in a bounded thin domain of the type $R^\varepsilon = \left\{(x,y) \in \mathbb{R}^2 : x \in (0,1) \text{ and } 0 < y < \varepsilon g\left(x/\varepsilon^\alpha\right)\right\}$ where g is a positive periodic function. We study the three cases $0 < \alpha < 1$, $\alpha = 1$ and $\alpha > 1$ representing respectively weak, resonant and high osillations at the top boundary. In the three cases we deduce the homogenized limit and obtain correctors.

Uniform stability of the ball with respect to the first Dirichlet and Neumann $\infty-$eigenvalues

João Vitor da Silva, Julio D. Rossi, Ariel Salort
Universidad de Buenos Aires, Argentina

In this Lecture we analyze how perturbations of a ball $\mathfrak{B}_r \subset \mathbb{R}^n$ behaves in terms of their first (non-trivial) Neumann and Dirichlet $\infty-$eigenvalues when a volume constraint $\mathcal{L}^n(\Omega) = \mathcal{L}^n(\mathfrak{B}_r)$ is imposed.

Our main result states that Ω is uniformly close to a ball when it has first Neumann and Dirichlet eigenvalues close to the ones for the ball of the same volume $\mathfrak{B}_r$. In fact, we show that, if

$$|\lambda^D_{1,\infty}(\Omega) - \lambda^D_{1,\infty}(\mathfrak{B}_r)| = \delta_1 \quad \text{and} \quad |\lambda^N_{1,\infty}(\Omega) - \lambda^N_{1,\infty}(\mathfrak{B}_r)| = \delta_2,$$

then there are two balls such that

$$\mathfrak{B}_{\frac{r}{\delta_1 r+1}} \subset \Omega \subset \mathfrak{B}_{\frac{r+\delta_2 r}{1-\delta_2 r}}.$$

In addition, we also obtain a result concerning stability of the Dirichlet $\infty-$eigen-functions.

This is joint work with Julio D. Rossi and Ariel M. Salort, Universidad de Buenos Aires, Argentina.

References:

[1] J.V. da Silva, J.D. Rossi and A. Salort, *Uniform stability of the ball with respect to the first Dirichlet and Neumann $\infty-$eigenvalues*, **Electron. J. Differential Equations** 2018, Paper No. 7, 9 pp.

Nonlocal equations in perforated domains

Marcone Pereira
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In this talk, we analyze the asymptotic behavior of nonlocal problems widely used in the modeling of diffusion or dispersion processes. We consider an integral-differential equation, with nonsingular kernel, in a limited domain Ω from which we remove subsets that we call holes. We deal with Neumann and Dirichlet conditions in the holes setting Dirichlet outside of Ω. Assuming the weak convergence of the family of functions which represents such holes, we analyze the limit of the solutions of the equations obtaining the existence of a limit problem. In the case where the holes are removed periodically, we observe that the critical radius is of order of the typical cell size (which gives the period). Finally we study the behavior of these problems when we resize their kernel with the objective of approaching local partial differential equations discussing peculiarities.