II Mini-Workshop in Partial Differential Equations

August 16-2013

Program:

10:00-10:30 - Fluidos micropolares com dados iniciais em espaços de Besov-Morrey
Juliana Precioso (IBILCE/UNESP)

10:35-11:05 - Rate of continuity of attractors for a parabolic problem discretized via finite element
Rodiak Figueroa López (IBILCE/UNESP)

11:10-11:40 - Almost periodicity for a class of neutral functional differential equations
Andréa Prokopczyk Arita (IBILCE/UNESP)

14:00-14:30 - Viscous Cahn-Hilliard equation in $\mathbb{R}^N$
Tomasz Dlotko (University of Silesia, Katowice, Poland)

14:35-15:05 - On the concept of attractors for non-autonomous dynamical systems
José Antonio Langa Rosado (Universidade de Sevilla, Espanha)

15:10-16:40 - Morse-Smale non-autonomous dynamical systems
Matheus Cheque Bortolan (ICMC-USP, São Carlos, Brasil)

Local: Sala de Seminários do Departamento de Matemática

Organizers: Germán Lozada Cruz (IBILCE/UNESP)
Juliana Precioso (IBILCE/UNESP)
Andréa Prokopczyk Arita (IBILCE/UNESP)
Fluidos micropolares com dados iniciais em espaços de Besov-Morrey
Juliana Precioso (IBILCE, UNESP)

Nesta palestra, mostraremos um resultado de existência local no tempo para o sistema de fluidos micropolares tridimensionais no âmbito dos espaços de Besov-Morrey. A classe de dados iniciais é maximal, isto é, é maior do que as anteriores e contém funções fortemente singulares e medidas.

Almost periodicity for a class of neutral functional differential equations
Andrée Prokopczyk Arita (IBILCE, UNESP)

In this work we study the existence of asymptotically almost periodic solutions for a class of second order abstract neutral differential equations of the form

\[
\frac{d^2}{dt^2} [x(t) + g(t, x_t)] = Ax(t) + f(t, x_t), \quad t \in [0, \infty),
\]

\[
x_0 = \varphi \in B, \quad (0.2)
\]

\[
x'(0) = \xi \in X, \quad (0.3)
\]

where \( A \) is the infinitesimal generator of a strongly continuous cosine family of bounded linear operators on a Banach space \((X, \| \cdot \|)\), \((C(t))_{t \in \mathbb{R}}\), the history \( x_t : (-\infty, 0] \to X \), \( x_t(\theta) = x(t + \theta) \), belongs to an abstract phase space \( B \) defined axiomatically and \( f, g \) are suitable functions.

References


Rate of continuity of attractors for a parabolic problem discretized via finite element
Rodiak Figueroa López (IBILCE, UNESP)

In this work we consider the parabolic problem

\[
\begin{cases}
  u_t = Lu + f(u), & t > 0, \ x \in \Omega \\
  u(t,x) = 0, & t > 0, \ x \in \partial\Omega \\
  u(0,x) = u^0(x), & x \in \Omega,
\end{cases}
\]  

(0.4)

where

\[
Lu = \sum_{i,j=1}^{n} \frac{\partial}{\partial x_i} (a_{ij}(x) \frac{\partial u}{\partial x_j}) + \sum_{j=1}^{n} b_j(x) \frac{\partial u}{\partial x_j} + (c(x) + \lambda)u
\]

is a second order operator with uniformly strongly elliptic condition, \(u^0 \in H_0^1(\Omega), \Omega \subset \mathbb{R}^n\) is a bounded domain with smooth boundary, \(n \geq 1, a_{ij}, b_j, c : \overline{\Omega} \to \mathbb{R}\) are smooth functions, \(\lambda \in \mathbb{R}\) and \(f \in C^2(\mathbb{R})\). Under certain growth and dissipativity conditions we have the existence of an global attractor \(A\) for (0.4) in a Banach space \(L^2(\Omega)\).

Our interest in this work is to study the robustness of attractor \(A\) under discretization by finite element method. In particular to study the continuity of the family of attractors \(\{A_h\}_{h \in (0,1]}\) when the global step size goes to zero. For this we use the concept of \(P\)--convergence given in [4].

References


Viscous Cahn-Hilliard equation in $\mathbb{R}^N$

Tomasz Dlotko (University of Silesia, Katowice, Poland)

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Abstract

Solvability of Cauchy’s problem in $\mathbb{R}^N$ for an extended viscous Cahn-Hilliard equation will be discussed. The problem is considered first in a standard Sobolev space $H^1(\mathbb{R}^N)$, next a notion of the 'H-solution' is introduced which is well adapted to the structure of the viscous Cahn-Hilliard equation. Several properties of an unbounded operator $(-\Delta)^{-1}$ in $\mathbb{R}^N$ needed in our considerations will be also reported.

The Cauchy problem for an extended viscous Cahn-Hilliard equation has the form:

$$
(1) \quad \begin{cases}
(1-\nu)u_t = -\Delta(\Delta u + f(x,u) - \nu u_t), & t > 0, \ x \in \mathbb{R}^N, \\
u(0,x) = u_0(x),
\end{cases}
$$

where $\nu \in [0,1)$ and the nonlinear term $f$ fulfills the required regularity and growth assumptions.

References


On the concept of attractors for non-autonomous dynamical systems

José A. Langa

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Abstract

Dynamical systems theory allows the modelization and study of multiple phenomena of Natural and Social Sciences. When the models are characterized by partial differential equations, the theory of global attractors for infinite-dimensional dynamical systems has been used during the last fifty years as the central object to study some of these phenomena. However, in the last two decades an intensive research has been done when time-dependent (or even random) terms are needed for the mathematical analysis of some real phenomena, described by the so-called non-autonomous dynamical systems. The dynamical properties of these extended dynamical systems is much richer, so that new concepts and tools have to be introduced and developed. In this talk we will try to describe the main topics related to this new area of research ([1], [2]), paying special attention to the theoretical aspects of the theory.

Referencias

Morse-Smale Non-Autonomous Dynamical Systems
Matheus Cheque Bortolan (ICMC-USP, São Carlos, Brasil)

In this lecture we define non-autonomous Morse-Smale dynamical systems and prove the phase diagram commutativity between attractors of a Morse-Smale semigroup and its non-autonomous perturbation.