Dynamics in the Schwarzschild isosceles three body problem

John Alexander Arredondo

Universidad Nacional Autńoma de México en Morelia
e–mail:alexander@matmor.unam.mx

Abstract

The Schwarzschild potential, defined as $U(r) = \frac{A}{r} + \frac{B}{r^3}$, where r is the relative distance between two mass points and $A; B > 0$, models astrophysical and stellar dynamics systems in a classical context. In this paper we present a qualitative study of a three mass point system with mutual Schwarzschild interaction where the motion is restricted to isosceles configurations at all times. We retrieve the relative equilibria and the behavior of the flow near triple collision.

Existence and uniqueness of almost periodic solutions for a hematopoiesis model

Rocio Balderrama

Universidad de Buenos Aires, Argentina
e–mail: rbalde@dm.uba.ar

Abstract

The following general nonautonomous Mackey-Glass equation for the regulation of the hematopoiesis (formation of blood cellular components) with several non-constant delays is studied:

$$x'(t) = \sum_{k=1}^{M} \lambda_k r_k(t) \frac{x^{m_k}(t - \tau_k(t))}{1 + x^{n_k}(t - \mu_k(t))} - b(t)x(t)$$

where $r_k(t), b(t), \tau_k(t)$ and $\mu_k(t)$ are positive almost periodic functions and λ_k, m_k, n_k are positive constants. $x(t)$ is the concentration of white cells in the circulating blood. Using fixed point methods in cones, we prove the existence and uniqueness of positive almost periodic solutions. Also, we present numerical simulations to check our results.

Liouville theorems for elliptic systems with gradient terms

Miguel Á. Burgos Pérez

Universidad de La Laguna, Spain
e–mail: miguelburgosperez@gmail.com

Abstract

We consider the elliptic system

$$\begin{cases} -\Delta u + |\nabla u|^q = \lambda v^p \\ -\Delta v + |\nabla v|^q = \mu u^s \end{cases} \qquad \text{in } \mathbb{R}^N \setminus B_{R_0},$$

where $N \geq 3$, $q > 1$, $p, s > 0$, $\lambda, \mu > 0$. We are interested in analyzing the question of nonexistence of positive supersolutions of this system. For several ranges of the exponents involved we show that no positive supersolutions can exist. These ranges of nonexistence turn out to be optimal in some cases.

On the Existence and Uniqueness of Solutions For A Nonlinear System Modeling Three-dimensional Viscous Stratified Flows

Tovias Enrique Castro Polo

Universidad del Atlántico, Colombia
e–mail: castroptovias@gmail.com

Abstract

We establish the uniqueness and local existence of weak solutions for a system of partial differential equations which describes non-linear motions of viscous stratified fluid in a homogeneous gravity field. Due to the presence of the stratification equation for the density, the model and the problem are new and thus different from the classical Navier-Stokes equations.

Impasse singularities of constrained differential systems in dimension three.

Ronaldo Garcia

Universidade Federal de Goiás, Brazil
e–mail:ronaldoagarcia@gmail.com

Abstract

This work is concerned with the classification of the impasse singularities of differential equations of the form $A(x)x' = F(x)$ where $A(x)$ is smooth 3×3 matrix and F is a smooth vector field in $\mathbb{R}^3$. The impasse occur at points where $A(x)$ is non-invertible. Global aspects also will be analyzed.

Work in progress with M. Zhitomirskii (Thechnion) and J. Sotomayor (USP).

Burenkov's type result for functions of bounded κ-variation

José Giménez

Universidad de los Andes, Venezuela
e–mail: jgimenez@ula.ve

Abstract

Burenkov's type result for functions of bounded κ-variation We present a sufficient condition for a linear composition operator to map the space of functions of bounded *Koremblum* variation, $\kappa BV[a,b]$, into itself. We present several results concerning quasi monotonic properties of the functionals of κ-variation and prove a Burenkov's type result for functions belonging to $\kappa BV[a,b]$.

Existence and multiplicity results for a Ermakov-Painlev'e II-type equation with radiation boundary conditions

Mariel Paula Kuna

Universidad de Buenos Aires, Argentina
e–mail: mpkuna@dm.uba.ar

Abstract

Let us consider the next equation for a function $u : [0,1] \to \mathbb{R}$,

$$u'' = g(x,u) + h(u),$$

where $h : (0,+\infty) \to \mathbb{R}$ has a singularity in $u = 0$, $g : [0,1] \times \mathbb{R} \to \mathbb{R}$ is continuous and superlinear, that is:

$$\lim_{|u|\to+\infty} \frac{g(x,u)}{u} = +\infty$$

uniformly in x. Subject to radiation boundary conditions

$$u'(0) = a_0 u(0),\ u'(1) = a_1 u(1),$$

whith $a_0, a_1 > 0$.

We shall study existence and multiplicity of positive solutions.

A particular case of interest is $g(x,u) = au^3 + bxu$ and $h(u) = \frac{c}{u^3}$ for a, b, c, a_0 and a_1 some specific constants. This Ermakov-Painlevé II equation arises out of a reduction of a Nernst-Planck system for three-ion electrodiffusion.

A food chain model holling type II with distributed delay

Teodoro Lara

Universidad de los Andes, Venezuela
e–mail: tlara@ula.ve

Abstract

In this research we introduce and study, analytic and numerically, a model of chemostat with distributed delay, this a generalization of the model, with no delay, first treated by Kuang. We give conditions for asymptotic stability, survival of species or extinction of them.

On the solvability of a quasilinear problem involving principal eigenvalues of the Steklov problem

Gustavo Madeira

Universidade Federal de São Carlos - Brasil
e–mail: gfmadeira@dm.ufscar.br

Abstract

In this talk we are interested in existence/nonexistence results for a nonhomogeneous problem for the p-Laplacian. Nonhomogeneous terms or sources appear in the equation and in the boundary condition, which is of Steklov type.

If the parameter is a nonzero eigenvalue of the associated Steklov eigenvalue problem, nonexistence of solutions is proved in the case of definite sign sources. When the parameter is zero one has a nonhomogeneous Neumann problem and a general necessary and sufficient condition for solvability is established. That result is related to the nonlinear Fredholm alternative for the p-Laplacian in dimensions greater than one under Neumann boundary condition.

Finally for p=2 we prove positivity and anti-maximum principles by allowing a bounded boundary indefinite weight and sources in suitable Lebesgue spaces.

On a Nonlinear Nonlocal Mixed Higher Order Boundary Value Problem

Said Mesloub

King Saud University, Saudi Arabia
e–mail: mesloub@ksu.edu.sa

Abstract

In this work, we prove the solvability of an initial boundary value problem for a certain class of higher order partial dfferential equations. Classical and nonl classical boundary conditions were combined. The existence and uniqueness of the generalized solution are established in a type of classical Sobolev spaces.

L1- Lp estimates for radial solutions of the wave equation and application

Tiago Picon

Universidade de São Paulo, Brazil
e–mail: picon@ffclrp.usp.br

Abstract

It is well known that, for space dimension $n > 3$, one cannot generally expect $L^1 - L^p$ estimates for the solution of

$$u_{tt} - \triangle u = 0, \qquad u(0,x) = 0, \quad u_t(0,x) = g(x),$$

where $(t,x) \in \mathbb{R}_+ \times \mathbb{R}^n$. In this work, we investigate the benefits in the range of $1 \leq p \leq q$ such that $L^p - L^q$ estimates hold under the assumption of radial initial data. In the particular case of odd space dimension, we prove $L^1 - L^p$ estimates for $1 \leq p < \frac{2n}{n-1}$ and apply these estimates to study the global existence of small data solutions to the semilinear wave equation with power nonlinearity $|u|^p$, $p > p_K(n) = \frac{n+1}{n-1}$, where the critical exponent $p_K(n)$ is the Kato index.

Mean-field games with logistic effects: One-dimensional case.

Ricardo Ribeiro

Universidade Estadual de Campinas, Brazil
e–mail: ricardodelimaribeiro@gmail.com

Abstract

We consider stationary mean-field games with logistic effects in dimension one. These mean-field games are written as a coupled system of Hamilton-Jacobi and a non-linear (stationary) Fokker-Plank equation.

$$\begin{cases} \frac{v_x^2}{2} + V(x) = \bar{H} + g(m) - m^\alpha v + v_{xx} \\ -(mv_x)_x = (1 - m^\alpha)m + m_{xx} + \delta. \end{cases}$$

Unlike in the standard mean-field games, the Fokker-Plank equation is not the adjoint of the linearization of the Hamilton-Jacobi equation because agents have a non-linear death rate in addition to birth and seeding effects which are natural in population dynamics. This model illustrates various techniques to obtain regularity for this class of equations.

Simulación de la precipitación enmeso escala para la región del Perú

Obidio Rubio Mercedes

Universidad Nacional de Trujillo, Perú

Abstract

En este artículo presentamos una descripción fenomenológica del concepto de precipitación y luego se aborda el proceso de modelación matemática de tods las variables que intervienen en la explicación del fenómeno, finalmente se describe el uso del Modelo computacional BRAMS, con el cual se realizaron algunas simulaciones numéricas que cooresponde a la región del Perú.

A supnorm version of Leray's conjecture for the incompressible Navier-Stokes equations

Lineia Schutz

Universidade Federal do Rio Grande do Sul, Brazil
e– mail:lineia.schutz@ufrgs.br

Abstract

We show that $t^{\frac{3}{4}}\|u(\cdot,t)\|_{L^\infty(\mathbb{R}^3)} \to 0$ as $t \to \infty$ for Leray-Hopf's global weak solutions $u(\cdot,t)$ of the incompressible Navier-Stokes equations in $\mathbb{R}^3$. Same important related results are also discussed. Our approach is elementary and is based on standard tools like conventional Fourier and energy methods.

The Brunn- Minkowski inequality for variable exponent spaces

Analia Silva

Universidad de Buenos Aires
e–mail: asilva@dm.uba.ar

Abstract

In this work, we define the Minkowski Sum for variable exponent spaces and extend the well known Brunn- Minkowski inequality in this context.

Existence of solution for a class of fractional Hamiltonian systems

César Torres

Universidad Nacional de Trujillo, Perú
e–mail: ctl_576@yahoo.es

Abstract

In this work we want to prove the existence of solution for a class of fractional differential equation given by

$$\begin{gathered} {}_tD^{\alpha}_{\infty}({}_{-\infty}D^{\alpha}_t u(t)) + L(t)u(t) = \nabla W(t,u(t)) \\ u \in H^{\alpha}(\mathbb{R},\mathbb{R}^N). \end{gathered} \tag{1}$$

where $\alpha \in (1/2,1)$, $t \in \mathbb{R}$, $u \in \mathbb{R}^n$, $L \in C(\mathbb{R},\mathbb{R}^{n^2})$ is a symmetric and positive definite matrix for all $t \in \mathbb{R}$, $W \in C^1(\mathbb{R}\times\mathbb{R}^n,\mathbb{R})$ and ∇W is the gradient of W at u. The novelty of this paper is that, assuming L is coercive at infity we show that (**??**) at least has one nontrivial solution.

A mathematical analysis of a model for phase transitions in dissipative isochoric thermoviscoelastic materials

Welington Vieira Assunção

Universidade Federal do ABC, Brazil
e–mail: welington.assuncao@ufabc.edu.br

Abstract

We analyze a highly nonlinear system of partial differential equations closely related to model the solidification and/or melting of thermoviscoelastic isochoric materials with the possibility of motion of the material during the process. This system features a balance equation for internal energy, governing the evolution of temperature, an evolution equation for the phase field parameter, whose values determine the state of material, and a moment balance equation governing the displacement. In this talk, we establish results of existence, uniqueness and regularity of solutions for such system. Joint work with Jos'e Luiz Boldrini (IMECC-UNICAMP)

On summability of moments for the Boltzmann equation for hard potentials with non-integrable angular cross-section

Maja Taskovic

University of Texas at Austin, USA
e–mail: mtaskovic@math.utexas.edu

Abstract

We consider the spatially homogeneous Boltzmann equation with non-integrable angular cross-section, for the case of variable hard potentials, and study the behavior of summability of fractional moments for its solution, leading to generation and propagation results of the so-called exponential moments of order $s \in (0, 2)$.

More specifically, we provide a new proof of the generation of exponential moments of order up to the rate of potentials with the classical non-cutoff assumption that the angular singularity does not grow faster than inverse third power at zero angle.

In addition, we study exponential moments of order beyond the rate of potentials and show their propagation in time under the modified angular singularity. For that purpose, we introduce Mittag-Leffler moments (which can be understood as a generalization of exponential moments).

This is joint work with Ricardo J. Alonso, Irene M. Gamba, and Natasa Pavlovic.

Exponential propagation for fractional reaction-diffusion cooperative systems with fast decaying initial conditions.

Miguel Yangari

Escuela Politécnica Nacional del Ecuador
e–mail: miguel.yangari@epn.edu.ec

Abstract

The aim of this paper is to study the time asymptotic propagation for mild solutions to the fractional reaction diffusion cooperative systems when at least one entry of the initial condition decays slower than a power. We state that the solution spreads at least exponentially fast with an index depending on the decay of the initial condition and on the principal eigenvalue of the matrix $DF(0)$ where F is the reaction term.