## ODEs and PDEs Session

# Monday June 21st

**1.30-2.00 PM** Asymptotic formulae of Liouville-Green type for higher even-order equations - A.S.A. Al-Hammadi

**2.05-2.35 PM** Existence and Exponential decay of solutions of a nonlinear damped wave equation with variable-exponent nonlinearities - Salim A. Messaoudi

**2.40-3.10 PM** Asymptotic behavior of Hyperbolic-Parabolic Equations in porous medium - Amar Ould-Hammouda

**3.15-3.45 PM** Break

**3.50-4.20 PM** Transformation properties of a class of (1+2)-dimensional financial models - C. Sophocleous

**4.25-4.55 PM** Fractional regularity result for the Non local Poisson equation and application to a KPZ problem with nonlocal “gradient terms” - Abdelbadie Younes

**5.00-5.30 PM** Homogenization of some nonlinear boundary value problems with L1 data in porous media - Taha k. Abassi

**Session Chairs: Prof. Al-Hammadi and Dr. Thuraya**

**Virtual Room 1E**

## ODEs and PDEs Session

# Tuesday June 22nd

**1.30-2.00 PM** Existence of dual solutions for the Homan stagnation point flows of nano fluids - Sohail Nadeem

**2.05-2.35 PM** Qualitative And Quantitative Features Of Delay Differential Equations Of Biological Systems with Memory - Fathalla A. Rihan

**2.40-3.10 PM** Some new Hardy-type inequalities on time scales - Ahmed A. El-Deeb

**3.15-3.45 PM** Break

**3.50-4.20 PM** Some well-posedness and stability results for thermoelastic Bresse-type systems with different kinds of heat conduction via the vertical displacements - Aissa Guesmia

**4.25-4.55 PM** On a class of double phase problems - Ahmed Aberqi

**5.00-5.30 PM** Existence and Nonexistence Results for p-Laplacian Kirchhoff Equation- Kamel Tahri

**5.35-6.05 PM** Fixed Points and Stability in Nonlinear Delay and Fractional Differential Equations - Bo Zhang

**Session Chairs: Prof. Al-Hammadi and Dr. Thuraya**

**Virtual Room 1E**

# ODEs and PDEs Session

# Abstracts

**Prof. A.S.A. Al-Hammadi (asalhamadi@uob.edu.bh)**
**Department of Mathematics, College of Science, University of Bahrain**

### Asymptotic formulae of Liouville-Green type for higher even-order equations

Asymptotic formulae of Liouville-Green type for general linear ordinary differential equations of an arbitrary even-order 2m are investigated. A theorem on asymptotic behavior at the infinity of 2m linearly independent solutions is proved. It is shown that numerous results known in the literature are contained in this theorem as particular cases.

**Dr. Salim A. Messaoudi (smessaoudi@sharjah.ac.ae)**
**University of Sharjah, Sharjah, UAE**

### Existence and Exponential decay of solutions of a nonlinear damped wave equation with variable-exponent nonlinearities

With the advancement of sciences and technology, many physical and engineering models require more sophisticated mathematical functional spaces to be studied and well understood. For example, in fluid dynamics, the electrorheological fluids (smart fluids) have the property that the viscosity changes (often dramatically) when exposed to an electrical field. The Lebesgue and Sobolev spaces with variable exponents proved to be efficient tools to study such problems as well as other models like the image processing. In this work, we consider the following nonlinear wave equation with variable exponents:

$$u_{tt} - \Delta u - \Delta u_t + |u_t|^{m(x)-2} u_t = 0, \quad in \ \Omega \times (0,T),$$

iwhere Ω is a bounded domain and $T > 0$. This models the propagation of waves in a viscoelasic material in the presence of a non-standard frictional damping due to the nature of the "smart" material. We will establish the existence of weak solutions and then prove the exponential decay of the solution under suitable assumptions on the variable exponent and the given initial data.

**Session Chairs: Prof. Al-Hammadi and Dr. Thuraya**

**Virtual Room 1E**

# ODEs and PDEs Session

# Abstracts

**Dr. Amar Ould-Hammouda (amar.ouldhammouda@g.ens-kouba.dz)**
**Physics Mathematics et Applications Laboratory, Algies, Algeria**

### Asymptotic behavior of Hyperbolic-Parabolic Equations in porous medium

we deal with study the asymptotic behaviour of a class of Hyperbolic-Parabolic problem in a perforated domain in R N , N ≥ 3, with small holes ε-periodically distributed. The size of the holes is of the order (εδ(ε)) with δ(ε) → 0 as ε goes to zero. On the boundary of some holes we prescribe a Dirichlet condition, on the boundary of the others, a Robin condition depending on a parameter γ is assumed . We focus on the homogenization of these equations, which generalizes those achieved by Z. Yang, X [3]. Zhao To do so, we use the periodic unfolding method introduced by Cioranescu, Damlamian and Griso in [1] and [2].

**Dr. C. Sophocleous (christod@ucy.ac.cy)**
**Department of Mathematics and Statistics, University of Cyprus, Cyprus**

### Transformation properties of a class of (1+2)- dimensional financial models

We consider a class of (1+2)-dimensional nonlinear partial differential equations. Special cases have been used to model recent problems in financial mathematics. Lie symmetries are used to construct two successive mappings that reduce the problems into problems with new governing equations being ordinary differential equations. Furthermore we show that these equations admit contact symmetries. The most significant is that they admit infinitedimensional contact symmetries which is a hint for linearization. In fact, the Legendre transformation, which is a contact transformation, maps this class into a linear (1+2)-partial differential equation.

**Session Chairs: Prof. Al-Hammadi and Dr. Thuraya**

**Virtual Room 1E**

# Abstracts

**Dr. Abdelbadie Younes (abdelbadieyounes@gmail.com)**
**Université Abou Bekr Belkaid, Tlemcen, Algérie**

**Fractional regularity result for the Non local Poisson equation and application to a KPZ problem with nonlocal "gradient terms"**

The main goal of this paper is to get regularity results for the Poisson fractional problem in a natural fractional Sobolev space. More precisely, for s ∈ (0, 1), we consider the following problem

$$\begin{cases} (-\Delta)^N u = f, & \text{in } \Omega, \\ u = 0, & \text{in } R^N \setminus \Omega \end{cases}$$

where Ω is a bounded regular domain and $f \in L^m(\Omega)$. According to the value of $m$, we get the regularity of the "fractional gradient" of the solution $u$. As a direct application of the regularity result, we will prove an existence result for a fractional KardarParisi-Zhang problem with variant forms of the fractional gradient, a simple one will be the following

$$\begin{cases} (-\Delta)^s u = D_s^2(u) + \lambda f(x), & \text{in } \Omega, \\ u = 0, & \text{in } R^N \setminus \Omega \end{cases}$$

where λ > 0 is a real parameter, $f$ belongs to a suitable Lebesgue space and $D_s^2$ is a nonlocal "gradient square" term given by

$$D_s^2(u)(x) = \frac{a\,N, s}{2} \int_{R^N} \frac{|u(x) - u(y)|^2}{|x - y|^{N+2s}}\, dy.$$

Depending on the real parameter λ > 0, we show existence and non-existence results.

# ODEs and PDEs Session

# Abstracts

**Dr. Taha.k .Abassi (tahaabassikhalile@gmail.com)**
**Laghouat University, Algeria**

### Homogenization of some nonlinear boundary value problems with $L^1$ data in porous media

We deal with the asymptotic bevavior a class of quasilinear elleptic problems in a periodically perforated domain in $R^N$ , N > 2 with small holes of size εδ [2] and $L^1$ data with nonlinear Robin conditions on the boundary of the holes. due to the very weak assumptions on the data we cannot have a priori estimates in $H^1(\Omega_{\varepsilon\delta})$, To do so, we use the notion of renormalized solution[3]. and the periodic unfolding method introduced in [1], but we can only apply it to the truncated solution, wich are in $H^1(\Omega_{\varepsilon\delta})$, so we have to describe the limits of the truncated unfolded solutions and of their gradients. This allow us to prove that we obtain at the limit an unfolded renormalized problem, as well as a (renormalized) homogenized problem in Ω.

**Dr. Sohail Nadeem (sohail@qau.edu.pk)**
**Quaid-i-Azam University Islamabad**

### Existence of dual solutions for the Homan stagnation point flows of nano fluids

This study examines the unsteady 3D non-axisymmetric Homann flow of an electrically conducting nanofluids in the presence of buoyancy forces. We consider the uniform external magnetic field, $\mathbf{B0}$, by neglecting induced magnetic field and examines the three possible directions of $\mathbf{B0}$ which coincides with the direction of axes. A similarity solution is derived which involve the dimensionless parameters $\varphi$,$M$,$\omega$,$\gamma$ and $\lambda$. We have treated the case for forced convection when $\lambda$=0 which arise from the singularity $\gamma=\mp 1$. We found that, for large $\gamma$ and $\lambda$, the leading terms of the solutions are independent of $M$ and $\omega$, and the effects of $\varphi$ in that solutions are negligible. Numerical results are found for illustrative values of all the flow parameters by using bvp4c scheme in MATLAB. The critical values $\lambda c$ of $\lambda$ are seen in opposing flow for small rate of deceleration parameter $\omega$ while it changes to assisting flow for large value of $\omega$.

**Session Chairs: Prof. Al-Hammadi and Dr. Thuraya**

**Virtual Room 1E**

# ODEs and PDEs Session

# Abstracts

**Dr. Fathalla A. Rihan (frihan@uaeu.ac.ae)**
**Department of Mathematical Sciences, United Arab Emirates University, UAE**

**Qualitative And Quantitative Features Of Delay Differential Equations Of Biological Systems With Memory**

Recently much attentions have been given to mathematical modeling of real-life phenomena using differential equations with memory, such as delay differential equations (DDEs). This is due to the fact that introduction memory terms in a differential model significantly increases the complexity of the model. Such class of DDEs is widely used for analysis and predictions in various areas of life sciences and modern topics in population dynamics, computer science, epidemiology, immunology, physiology, and neural networks. In this talk, we provide a wide range of delay differential models that have a richer mathematical framework (compared with ODEs) for the analysis of biosystems. Qualitative and quantitative features of DDEs are discussed. Some numerical simulations are also provided to show the effectiveness of the theorical results.

**Dr. Ahmed A. El-Deeb (ahmedeldeeb@azhar.edu.eg)**
**Al-Azhar University, Cairo, Egypt**

**Some new Hardy-type inequalities on time scales**

In this paper, we will prove some new dynamic inequalities of Hardy-type on time scales. Some of the integral inequalities that will be derived from our results in the continuous case are original. The main results will be proved by using the dynamic H¨older inequality, integration by parts formula on time scales and Keller's chain rule on time scales.

**Session Chairs: Prof. Al-Hammadi and Dr. Thuraya**

**Virtual Room 1E**

# ODEs and PDEs Session

# Abstracts

**Dr. Aissa Guesmia (aissa.guesmia@univ-lorraine.fr)**
**University of Lorraine, Metz, France**

**Some well-posedness and stability results for thermoelastic Bresse-type systems with different kinds of heat conduction via the vertical displacements**

The objective of this work is to study the stability of linear onedimensional thermoelastic Bresse-type systems in a bounded domain, where the coupling is given through the first component of the Bresse model with the heat conduction of (i) type I or (ii) type III or (iii) second sound or (iv) GurtinPipkin type. We state the well-posedness and show the polynomial stability of the systems, where the decay rates depend on the smoothness of the initial data. Moreover, in cases (iii) and (iv), we prove the equivalence between the exponential stability and some new conditions on the parameters of the systems. However, in cases (i) and (ii), we prove the non-exponential stability independently of the parameters of the systems. The proof is based on the semigroup theory and a combination of the energy method and the frequency domain approach. A part of these results was obtained in collaboration with Mounir Afilal (University of Cadi Ayyad, Morocco) and Abdelaziz Soufyane (University of Sharjah, UAE). A part of these results was published in Applicable Analysis (2020).

**Dr. Ahmed Aberqi (aberqi_ahmed@yahoo.fr)**
**Laboratory LAMA, Department of Mathematics, Sidi Mohamed Ben Abdellah University,National School of Applied Sciences Fez, Morocco**

**On a class of double phase problems**

In this talk, we discuss the existence and uniqueness of a non-trivial solution of the fractional nonlinear elliptic equation on Riemannian manifolds of type:

$$\begin{aligned} (-\Delta_g)_p^s\, u(x) + |u|^{p-2}\, u &= f(x,u), \quad \text{in } \Omega, \\ u &= 0, \quad \text{in } M \setminus \Omega \end{aligned}$$

where N > ps with s ∈ (0, 1), p ∈ (1, ∞), $(-\Delta_g)_p^s$ is the fractional $p$-Laplace operator defined as on compact Riemannian manifolds $M$.

**Session Chairs: Prof. Al-Hammadi and Dr. Thuraya**

**Virtual Room 1E**

# ODEs and PDEs Session

# Abstracts

**Dr. Kamel Tahri (tahri_kamel@yahoo.fr)**
**High School of Management, Tlemcen, Algeria**

### Existence and Nonexistence Results for p-Laplacian Kirchhoff Equation

This paper is dedicated to investigating the following elliptic equation with Kirchhoff type involving the p-Laplacian operator. Using variational methods and critical points theory, we prove that the above problem has a positive solution and multiplicity result in certain cases. Our result is regarded as general which extend the results of related literatures. At the end, we give some real applications.

**Prof. Bo Zhang (bzhang@uncfsu.edu)**
**Department of Mathematics and Computer Science, Fayetteville State University Fayetteville, NC 28301 U.S.A.**

### Fixed Points and Stability in Nonlinear Delay and Fractional Differential Equations

In this paper we study a nonlinear scalar differential equation with variable delays and give conditions to ensure that the zero solution is asymptotically stable by applying Schauder's Fixed Point Theorem. These conditions do not require the boundedness of delays, nor do they ask for a fixed sign on the coefficient functions. An asymptotic stability theorem with a necessary and sufficient condition is proved. The same technique is also applied to some nonlinear fractional differential equations of Caputo type. It is shown that similar results can be obtained for system of differential equations.

**Session Chairs: Prof. Al-Hammadi and Dr. Thuraya**

**Virtual Room 1E**