1506
UNIVERSITÀ
DEGLI STUDI
DI URBINO
CARLO BO

COMPETITION FOR YOUNG RESEARCHERS (age limit 40 years old)
AT THE URBINO UNIVERSITY
SUPPORTED BY ACRI "YOUNG INVESTIGATOR TRAINING PROGRAM 2018"

Attachment 1

Application form

The following declarations are given according to articles 46 and 47 of D.P.R. n. 445/2000.

Title: Dr.

Name and Surname: Gurpreet Singh

Date of Birth:

E-mail:

Phone number:

Home Address (residence):

Languages skills (please speficy English, French or Italian):

I carry out research activities in the following areas: ☑ **Non Linear Analysis** ☑ **Calculus of Variations** ☐ **Algebraic Geometry**

Affiliation (University, Research Center, ecc.):

Role (e.g. adjunct professor, phd fellow, etc ... ; please specify starting date and end date):

Contact Person at the affiliated Institution:

Proposed title for the conference talk (11-12 July 2019, Urbino):

Brief Abstract (max 5 lines):

Università degli Studi di Urbino Carlo Bo
Amministrazione Centrale
DATA - 9 APR 2019
PROT. 11807
CLASS. 11/12 FASC.

Settore Ricerca e Terza Missione
Ufficio Ricerca e Relazioni Internazionali
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Selected hosting institution (please see the list of host institutions):

1st choice:

2nd choice:

3rd choice:

4th choice:

5th choice:

Proposed visiting period:

Please fill in the following details (insert additional fields if needed)

WORK EXPERIENCE

Title *Date*

Institution

Title *Date*

Institution

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PUBLICATIONS (max 20)

PROPOSED RESEARCH PROJECT DURING THE VISITING PERIOD (max 30 lines)

Abstract:
The project aims at developing new techniques in the study of Systems of Partial Differential Equations. We target coupled nonlinear equations motivated by real life phenomena arising in Fluid Mechanics, Biology and Chemistry. The applicant developed in his PhD thesis new methods for investigating the asymptotic behaviour of radial solutions corresponding to steady-state systems in viscous fluids that rely on the study of the invariant manifold and a method for the study of regularity of solutions for quasilinear elliptic systems was obtained. Also, investigated the existence of ground state solution by using variational approach. In this project we intended to embed qualitative methods into a broader range of mathematical problems inspired by applications from real life and modelled by Partial Differential Equations through nonlinear systems. Both existence and non existence of solutions will be considered. Our findings will be next used to devise numerical methods for a quantitative study of the systems of Partial Differential Equations.

Objectives and Methodologies:
Many physical, chemical, biological, environmental and even sociological processes are driven by coupled differential equations called "systems". One relevant example in this class are the reaction-diffusion systems; these are multi-component models involving two different mechanisms: on one hand there is diffusion, a random particle movement, and on the other hand there are chemical, biological or sociological reactions representing instantaneous interactions, which depend on the state variables themselves and possibly also explicitly on the particles' position. The British mathematician Alan Turing suggested that the two components can react and diffuse in such a way to produce steady-state heterogeneous spatial patterns of chemical or morphogen concentration. He showed that a system of two reacting and diffusing chemicals could give rise to spatial pattern from initial near homogeneity. Turing showed that under certain conditions on the parameter values, a steady-state could be linearly stable in the absence of diffusion but unstable in the presence of diffusion; this is the now well-known phenomenon of diffusion driven (or Turing) instability.

Research Plan:
Obtaining a priori estimates for the elliptic and parabolic systems is a first step towards a qualitative and quantitative study in the project. Deriving good a priori estimates will be useful for both qualitative and quantitative study in the project. Once a priori estimates are established, variational approach and minimization methods can be used in order to obtain the existence of the solution.

Relationship with current research:
This proposal spans over both qualitative and quantitative aspects of systems of partial differential equations that arise in mathematical models of real life phenomena. On qualitative side, I intend to investigate existence and nonexistence of solutions satisfying such systems. One starting point in my plan emerges from my results in "On a class of mixed Choquard-Schrodinger Poisson systems" where I was able to obtain nonexistence of solution using a Pohozaev type identity and existence of ground state solution by using a variational approach. I intend to further expand this research in a more general setting which require the development of new techniques. Once we have a better understanding of the qualitative features of solutions for systems of differential equations, we can next proceed to improve the existed or implement new algorithms in numerically approximating such solutions.

Place and date

Signature

Submit your application and enclose, as separate files, a copy of your passport/ID card reporting personal details, and a full CV.

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