A Report on National Programme on Differential Equations: Theory, Computation and Applications (NPDE-TCA) 2012-2016 Project No. SERB/F/1279/2011-2012

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On the Behalf of the National Committee

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August 23, 2016

On Project

- Project No. SERB/F/1279/2011-2012/dated 09/01/2012.
- Investigators: Amiya K. Pani, Neela Nataraj, S. Baskar and Sivaji Ganesh Sista
- Date of start of the project: 10th February, 2012, but academic programme started from April, 2012.
- Date of Completion: 09th February,2017. But hope to complete it by 31st March,2017.

Mission

To Create Human Resource and Knowledge Generation in Academia & Industry on Differential Equations: Theory, Computation and Applications

Objectives

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- To create a pool of trained mathematicians to support the advancement of science and technology in general and reap its benefits for the development of the society.

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- To promote fruitful interaction between academia and industry.

Major Outcomes

- One of the intangible benefits of the programme is the mathematical maturity, which the participants gain as a result of attending the lectures by resource persons, who are experts in these areas. We believe that this has helped in their overall understanding and outlook of the current trends in PDEs and Numerical Analysis.

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- Students in rural areas are also chosen for this programme and this has helped in giving them exposure to DE and has possibly helped them to choose an academic career path.
- A large number of girl students has been trained in all our programmes. In our country, the number of women who have exposure to higher education is quite less and NPDE programmes do support the idea of giving ample opportunities given to women.

Major Outcomes-Contd..

- The visit of eminent Professors as a part of this programme has benefited many faculty members, who are working in Applied Mathematics. The constant interaction has not only resulted in many joint publications with reputed faculty from abroad, but also has been playing a role in mentoring research scholars.

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- An informal forum on Differential Equations: Theory, Computations and Applications has been helping the local groups to organize two CIMPA Schools, already one international conference and other programmes.
- Formation of different groups such as : *Control and Optimal control, Evolution Equations: Theory and Computation, Finite Element Analysis, Multiscale Problems, Bio-mathematics, Industrial Maths.*

Major Outcomes-Contd..

- Through Modelling and Study Group Meetings with industry every year, for the last 4 years, participants have started getting a feel for industrial problems and in a similar manner, industries have started looking forward for greater interaction.
- Through the training programmes, several lecture notes are put in the web site and a couple of those notes may be put in book form.

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- Through the training programmes, several lecture notes are put in the web site and a couple of those notes may be put in book form.
- Apart from Ph.D theses under the supervision of PI & Co-PI's, more Ph.D theses were written (each in IITK, Panjab University, Ravenshaw University, South Asian University) in the areas different from areas of expertise of the PI's. It is a positive outcome of the National Programme.

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2. **Activity 2: Advanced Workshops, Visitors Programmes and Summer Internships**
   (a) One-Week Programmes on Advanced Topics
   (b) Modeling Week and Study Group Meeting on Industrial Problems
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Now a brief outline of these activities is presented with outcomes.

Activity 1(a) : UG level training programme

Goals:

- To train undergraduate (B.Sc. and B.Tech.) students in the areas of d Differential Equations, Modelling and Scientific Computing.
- To expose the participants to scientific computing lab sessions with hands on computing.
- To provide a flavor of applied mathematics by exposing them to the links between basic mathematical tools and applications.

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Duration: **Three weeks**

Total number of students trained: **271**

Activity 1(b) : PG Level training programme

Goals:

- To motivate young students to pursue a career in the proposed areas by providing platform to link to DEs and Modellings to other areas of Mathematics.
- To train final year B.Sc, B.Tech. and first year M.Sc. students in DEs, Scientific Computing and Modelling.
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Activity 1(b) : PG Level training programme

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Student background: *Training Programme I and/or B.Sc., first year M.Sc., final year B.Tech.*

Total number of students trained: **283**

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Broader Theme : Pre Ph.D training

Topics covered: Functional Analysis; Distribution Theory; Sobolev Spaces;Elliptic, Parabolic, Wave Equations and Hyperbolic Systems, FEM with hands on computations. Sometimes some special topics.

Duration and Total trained: **Three weeks** and **280**.

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Now we detail the activities under this heading.

Activity 2(a): Advanced One Week Workshops

Broad Objectives

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Progress:

- A total of 29 one week workshops conducted in different parts of India.
- Around 1052 participants in total.

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- This was on the lines of study group meetings organized by OCIAM or OCCAM, Oxford Univesity.
- Such meetings not only provide many interesting problems and give a first hand experience for the participants on problems from industry, but additionally the interaction with the participating industries brings new opportunities in terms of jobs and association in terms of long term projects.

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Progress:

- A total of 4 two weeks workshops conducted.
- Around 222 participants in total.

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- A good number of CIMPA schools on Numerical Analysis is conducted regularly in India now (2013, 2015 and in 2017). The NPDE workshops provide a way to train the participants for the CIMPA programme, where many international resource persons visit and lecture on the state-of-the-art topics.

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Activity 2(d) : Summer Internship Programme

- Started with a motto: *Learn mathematics while working on a real life problem*; the programme is becoming more popular year after year.
- Number of applicants is around 200-300 every year.
- Total man power trained through this programme till now in the last five years is 121.

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- The infectious enthusiasm for research of very active visitors, who are experts in subject areas are translating to young researchers and faculty members in the country.
- The programmes at different levels have helped students, researchers and young faculty members in realizing their potential and working towards attaining positive goals.

THANKS A LOT