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PROFILE

Dr. N. Rudraiah

Dr. N. Rudraiah, an UGC Emeritus Fellow and Honorary Professor at UGC- DSA Centre in fluid mechanics, Department of Mathematics at Bangalore University. is a Honourary Director of NRIAM (National Research Institute for Applied Mathematics) Bangalore.

Born in Bellave, at Tumkur District, Karnataka, Dr. Rudraiah had completed his studies at central college, Mysore, and migrated to Canada to do M.A in Applied Mathematics at the University of Toronto. After completing his Ph.D in Fluid Mechanics at Canada, he was back in India to continue his noble profession of teaching at Mysore and Bangalore Universities. He has been carrying out an indepth research work in fluid Mechanics and allied Areas of Applied Mathematics, since 1959. Over 230 research papers and a number of books stand as monuments to his research work and academic credibitity. Under his inspiration and able guidance 35 scholars have obtained Ph.D degree in applied mathematics

Fellowships of the Academies

1. Fellow of the Indian National Science Academy (FNA), New Delhi
2. Fellow of the Indian Academy of Sciences (FASc), Bangalore.
3. Fellow of the Indian National Academy of Sciences (FNAsc), Alahabad.
4. Fellow of the Institute of Mathematics and its Applications (FIMA), UK.
5. Fellow of United Writer's Association, (FUWA), India
6. Emeritus Fellow of UGC, New Delhi 2000-2002.

Honours Received:

1. UGC National Lecturership in Mathematics. 1974-1975
2. FICCI Gold Medal and Cash Award for outstanding contribution to Science and Technology-Physical Sciences including Mathematics - 1979
3. Karnataka State Rajyotsava Award in the Field of Education - 1986
4. KIT - International award for Foreign researcher - 1990
5. Prof. V.V. Narlikar Award - 2002
6. Kannada Shitya Parishath Award for contribution to Higher Education - 2002
7. "Distinguised Service Award" of vignana Parishad; New Delhi for his outstanding Contribution to promote Applications of Mathematics in India (2002)

Professional Bodies

1. Member of the International Society for the interaction of mechanics and Mathematics, Poland, 1982 onwards.
2. Life Member of the Indian Mathematical Society.
3. Life Member of the Indian Society of Theoretical and Applied Mechanics.
4. Life Member of the Indian Plasma Physics Society.
5. Life Member of the Indian Science Academy, New Delhi.
6. Life Member of the Indian National Science Academy, New Delhi.
7. Life Member of the Indian Academy of Sciences, Bangalore.
8. Life Member of the Indian Academy of Science, Allahabad.
9. Life Member of the Indian Society of Biomechanics.
10. Member of the Academic Council, Sri Sathya Sai Institute of Higher Learning, Puttaparthi, A.P, 1984-86.
11. Member of the Advisory Committee of the UGC- DSA Project, Department of Mathematics, Jadavpur University, Calcutta, 1990-94.

12. Member, National Book Trust, 1991-93.

13. Member of New York academy of Sciences, New York, 1997

14. UGC Standing Committee for Sciences, Engineering and Techniques.

15. Member of ISRO Standing working Group. 1998.

16. Member of advisory committee to select CSIR Young Scientists, 1998

17. Coordinator to select Vice-Chancellor of Pondichery University 1997

18. Member to select Vice-Chairman of UGC 1997

19. Coordinator of UGC visiting team to Bharathiyar and Bharathidasan Universities under 8th Plan assessment and 9th Plan projection.

20 Member of UGC - Standing Committee Sciences (Physics, Chemistry, Mathematics, Geological, Earth and Energy Sciences), Engineering and Technology.

21 Member of UGC Mathematical Sciences Panel 1975-78, 1993-96, 1998 onwards.

22. Member of Research Board of Advisors of ABI. New York, USA.

23. Member of Canadian Award "C.L. Chandan Mathematics Award" - Saraswati Vikas, Canada, 1998

24. Life member of Indian Society of Magnetic Fluids

25. Member and Fellow of Institute of Mathematics and its Applications, UK.

Collaborative Research work with other countries

1. Prof. D. Vortmeyer and Prof. R. Friedrich, Technical University of Munich. Germany.

2. Prof. P.N. Shivakumar, University of Manitoba, Canada.

3. Prof. O.P. Chandan, Prof. P.N. Kaloni and Prof. R.M. Barron, University fo Windsor, Canada.

4 Prof. M.R. Garg, Acadia University, Canada.

5. Prof. R. Narayana, University of Florida, USA.

6 Prof .W. Unno, Univesrsity of Tokyo, Japan.

7 Prof. T. Masuoka, Kyushu Institute of Technology, Japan.

8 Prof. S. Kamiyama. Tohoku Univsersity, Japan

9 Prof. Vishwanath Prasad, State Univesrsity of Newyork, Stony Brook, New York, USA

Research Contributions

1. Stability of Flows.

Several Problems on the stability of stratified flows in the presence of geomagnetic field have been investigated to analyse the energy and momentum transfers in the atmosphere with the view of studying the vagaries in the atmosphere. A new semicircle theorem which explains the growth of frequency of disturbances in the atmosphere has been established. The existence of an analog of the Richardson number in MHD has been proved. This problem has also been extended to include thermal stratification. The stability of flow in the porous medium is investigated because of its importance in many biomechanical problems particularly in the cardio-vascular system. Studies in the stability of Unbounded flows in the atmosphere are in progress.

2. Magnetohydrodynamics

The solutions obtained by the use of regular and singular perturbation techniques of MHD problems in different geometrical configurations are relevant to the better performance of lubrication in heavy electrical motors and machineries. The efficiency of MHD Generators based on our mathematical models using salt water has been tested.

3. Convection & Heat and Mass transfer

Linear and nonlinear convention in a pours medium and magneto convection in single and multi-component systems have been extensively investigated. The findings of his study help to analyse the transfer of energy from the deep interior of the earth to shallow depths which is important in the extraction of the geothermal energy. By employing the dispersion theory in a porous medium, the amount of transport of chemicals into the water belt region has been determined. This investigation has

relevance in controlling pollution in water belt caused by chemicals injected into the soil.

Our study of cross-diffusion in a multi-component system in a porous medium with chemical reaction is useful in calculation of the gradients required for transporting the nuclear waste dumped in the geological media to shallow depth. This may help to prevent accidents caused by nuclear reaction. Our study of double -diffusive convection in a porous medium has brought out the following three functions which are important in the extraction of solar energy:

1) a heat exchanger extracting thermal energy from the hot air supplied by the solar collectors

2) Thermal energy store, and

3) energy distribution system for heating purposes.

4. Flow through the past porous media

May industrial problems like gas cooled reactors involve high temperatures (of the order 1300° C) and high pressure (of the order 40 atmospheres). It is difficult to find materials which sustain such high temperature and pressure. Our study of flow through and past a porus medium will help to use porous materials as an effective insulation. The main crux of this problem lies in finding a proper boundary condition at the porous surface. In 1967 Beavers and Joseph (of the University of Minnesota) proposed a rather adhoc boundary condition which is now known as BJ- slip condition. This Condition does not take into account the depth of the material and is found to be valid only for large thickness. However, many industrial problems involve finite thickness. Recently we have proposed a modified boundary condition that takes into account the thickness of the porous material (BJR- Slip condition). This condition has been found to be useful not only in amy industrial problems but also in may bio-mechanical problems. The condition is now being further explored in regard to its application to stability problems.

5. Internal Gravity Waves

Our study of internal gravity waves across a critical level in a compressible and incompressible atmosphere in the presence of Coriolis force and Lorentz force play an important role in understanding the momentum and energy transfers from one region helps to understand the atmospheric turbulence which is important in weather forecasting, the effects of turbulence on these waves are being investigated.

6. Bio-mechanics

Our study of particulate nature of blood in the microcirculation has attracted interest in understanding the rheological properties of blood. In particular our study of dispersion of red blood cells. White cells and platelets in blood plasma wit couple stresses has brought the rheological anomalies associated wit blood flows. In a series of papers we have identified a cause for haemolysis and proposed a mechanism to prevent haemolysis using static electrofield that exists in the human system. In a series of papers we have also suited the synovial joints and proposed a mechanism of transfer of nutrients and oxygen which are useful for the survival of cartilages. The work on the realistic rehological problems. Incorporating the non-Newtonian characteristics of the blood and the resistance offered by the cells to flow is in progress.

7. Chaotic Motion

Several numerical algorithms, codes and packages have been developed with the view of solving chaotic behavior in a high non linear flow in complicated geometries.

8. Non- Newtonian fluid flow through porous media

The Newtonian hypothesis has worked very well in explaining many physical phenomena in a fluid-saturated porous medium. But it is now well known that fluids behave in a Newtonian fashion only in ordinary situations. In many practical situations e.g. in the geothermal region and in bio-mechanics, howeve, it has been found that fluids occupying porous media show a distinict deviation from the Newtonian incompresible guilds in a porous medium using Maxwell and Oldroyd models. The study with other Non-Newtonian models are in progress.

9. Convention in Magnetic Fluids

The study of magnetic fluids which is of recent origin is an interdisciplinary topic having inherent interest of a physical and mathematical nature. It has wide practical applications in industrial problems particularly, convective heat transfer in magmatic fluids can have applications inthe cooling of current carying conductors in motors, transmission lines and other electrical equipments where field is present due to the current. Work on this is in progress.

10. Hydrodynamic dispersion

Our studies on Hydrodynamics dispersion's are concerned with

1. Bio-medical applications and
2. Groundwater pollution
3. Environment pollution

The time-dependent dispersion coefficients obtained in these cases predicts dispersion right from time zero upto the time at which it attains and equilibrium value. The study of dispersion in the presence of electric field is shown to be of vital importance in the Control of Haemolysis. The work on dispersion on Non-newtonian fluid flows is in progress.

Q: *What is the role of mathematicians in todays world of technology?*

1. The main object of studying mathematics is to enable students to make use of it in day to day life. This is possible only if he applies what he has leamt in Mathematics. This requires not only acquiring knowledge on basic principles but also learn the skills of why to apply, where to apply and how to apply mathematics in day to day We. That is why great mathematicians like. Gauss and others pointed out that mathematics unify different branches of science (Physical Science, Life Sciences, Social Science, Engineering Sciences and Medical Sciences). This statement is universal which was true in those days, true today and will be true in future. What is really needed is to learn good mathematics and acquire the skill of applying it to practical problems. In my opinion, the future of research in mathematics will be bright if he develops the principles of mathematical modeling. This requires ability to explain a problem to be solved in Science in a simple language in such a way that even a layman can understand the gist of the problem. The problem may be from Physical Science, Biologiral Science, Engineering Science, Medical Sciences, Social Sciences and so on. This requires understanding of the fundamentals of the problem. After acquiring these fundamentals a mathematician should develop basic equations and the corresponding initial boundary and surface conditions pertaining to the problem of investigation. He should be in a position to solve these equations either analytically or numerically depending whether those equations are linear or nonlinear. The solutions obtained should be validated either with experiments or available, data. Then he should be in a position to draw conclusions and verify whether they are consistent with the motivation of the problem. In other words, a researcher in mathematics, trained in mathematical modeling explained above, will contribute significantly to the chosen field and his future will be bright.

Q *What are your achievements as a former Vice-Chancellor of Gulbarga University?*

Gulbarga University is situated in a backward Hyderabad - Karnataka region. I accepted this appointment with the mission of developing such subjects and schemes with the support of people of that area to alleviate the backwardness of the area by inculcating discipline, commitment and hard work among the teaching and non-teaching staff and students.

I have introduced PG courses like MCA, MBA, M.Sc in Sugar Technology, M.Sc in Instrumentation Science, etc.

My other achievements are:

I. Instrumentation Centre.

II. Infrastructure Facilities had phenomenal growth

III. Extra Curricular Activates - All India Youth Festival, All India Cricket Tournament South, Zone Youth Festival Athletic Meet, were organized during my period.

IV National and International and conferences held at the university

V. STEP - Students Talent Enrichment Programme.

Under this scheme both UG and PG students were trained by specialists drawn from different institutions and Universities in the country in the areas of preparing them to face interviews, training them to deliver platform speeches and so on. This scheme has helped many student to get selected at KPSC and other competitive examinations.

VI SWEEP - Sopken, Written English Enchrichmet Programme

The students of this area were lagging behind in written and spoken English. To over come this Spoken and Written English programme were organized throughout the year by inviting experts form the institute of English, Hyderabad and Institute of Languages Bangalore.

Q *What is your area of Specialization in Mathematics?*

My area of specialization in mathematics is Fluid mechanics, a branch of applied Mathematics. I Have applied this field to study stability problems arainsing in Astrophysics, Geophysics and Industrial Problems. I have also applied this field to slove many problems posed by the industry NGEF, particularly in their motors and transformers. I have applied this field to solve

many problems connected with heat and mass transfer arising in many branches in Science, Engineering and Technology. I have studied extensively the flow though and past porous media with application to biomechanics, bioengineering like Haemolysis, a disease connected with loss of Hemoglobin in the blood. Synovial joints and coronary artery diseases, inertial fusion energy and cooling of machinery in industries.

Q *As a great Mathematicians and an Academician, how do you feel ?*

I have developed a new boundary condition valid at the interface between fluid and porous layer involving the thickness of porous layer and is now named after me. If the thickness of the porous layer tends to ∞ in my boundary condition, we can recover the Beaver and Joseph boundary condition valid for infinite depth of porous layer. Hence my boundary condition is now called BJR condition.

My work on the stability of stratified conducting fluids with the external constraint of magnetic called MHD instability is cited in many books and is considered to be the first of its kind. In Particular, my semicircle theorem in MHD is considered to be a novel method in determining the frequency of oscillations.

My students and I have done extensive work in the area of linear and non-linear convection in single component, two-component and multi component convection in porous media and in magneto convection in the presence of magnetic field and rotation.

We have studied extensively, the linear and non-linear internal Alfven and gravity waves in the atmosphere and porous media. Our work on critical level behaviour and wall type of effects in the study of these waves is considered to be first of its kind in the literature.

Besides these we have also done extensive work on developing analytical and numerical techniques in applied mathematics to solve many non-linear problems.