

Faculty Profile

Dr. Venkatarao Chukka

Assistant Professor,
Department of Mathematics,
Albert Einstein School of Physical Sciences,
Assam University (A Central University),
Silchar, Assam-788011, INDIA.
Email: venki003@gmail.com
Mobile: +91 9573335535



Education:

- **Ph.D.** in Mathematics at **National Institute of Technology, Warangal (NITW)**, Telangana, India, from December-2014 to June-2018.
Supervisor: Dr. Ch. Ramreddy, Assistant Professor, Department of Mathematics, NIT-Warangal.
Thesis Title: *Convective Heat and Mass Transfer in a Nanofluid Flow over Frustum of a Cone.*
- **M.Sc.** in Mathematics at **Pondicherry University (A Central University)**, Puducherry, India, from June-2007 to May-2009.
- **B.Sc.** in Mathematics at **Andhra University**, Visakhapatnam, Andhra Pradesh, India, from June-2004 to May-2007.

Teaching Experience:

- **August-2020 to Present:** Assistant Professor, Department of Mathematics, Albert Einstein School of Physical Sciences, Assam University (A Central University), Silchar, Assam, India.
- **June-2018 to July-2020:** Assistant Professor, Department of Mathematics, MVGR College of Engineering (A), Vizianagaram, Andhra Pradesh, India.
- **December-2014 to June-2018:** Teaching Assistant, Department of Mathematics, National Institute of Technology, Warangal, Telangana, India.
- **August-2011 to December-2014:** Assistant Professor, Department of Mathematics, MVGR College of Engineering, Vizianagaram, Andhra Pradesh, India.
- **September-2009 to August-2011:** Lecturer, Department of Science and Humanities, JNTUK University College of Engineering, Vizianagaram, Andhra Pradesh, India.

Achievements:

- Qualified Graduate Aptitude Test in Engineering (GATE-2014) Conducted by IIT-Kharagpur with All India Rank-254.
- Qualified State Eligibility Test (SET-2012) Conducted by Osmania University, Andhrapradesh.

Published Papers:

1. **Ch. Venkata Rao** and Ch. Ramreddy, Double-Diffusive Natural Convective Flow of a Nanofluid past an Inclined Wavy Plate in a Non-Darcy Porous Medium, *International Journal of Mathematical, Engineering and Management Sciences*, 4(6), 13731383, 2019. (Indexed in Scopus)
2. P. Murali Krishna, Ch. Ramreddy and **Ch. Venkata Rao**, Effects of Double Stratification on MHD flow and Heat Transfer of Nanofluid along a Permeable Vertical Plate, *International Journal of Mathematical, Engineering and Management Sciences*, 4(6), 13621372, 2019. (Indexed in Scopus)
3. **Ch. Venkata Rao** and Ch. Ramreddy, Natural Convective Flow of a Radiative Nanofluid past an Inclined Plate in a Non-Darcy Porous Medium with Lateral Mass Flux, *Lecture Notes in Mechanical Engineering*, 93-102, 2019. (Indexed in Scopus).
4. Ch. Ramreddy and **Ch. Venkata Rao**, Effects of Arrhenius Activation Energy and Binary Chemical Reaction on Convective Flow of a Nanofluid over Frustum of a Cone with Convective Boundary Condition, *International Journal of Chemical Reactor Engineering*, 16(3), 2018. (Indexed in SCIE, Scopus).
5. Ch. Ramreddy and **Ch. Venkata Rao**, Non-Similarity Analysis for Nonlinear Convective Flow of a Nanofluid over the Permeable Wavy Frustum of a Cone with Convective Boundary Condition, *Journal of Nanofluids*, 7, 1258-1271, 2018. (Indexed in Emerging Sources Citation Index, Scopus).
6. Ch. Ramreddy and **Ch. Venkata Rao**, Numerical Study for Mixed Convective Flow of a Radiative Nanofluid Over the Vertical Frustum of a Cone with Arrhenius Activation Energy and Binary Chemical Reaction, *Advanced Science, Engineering and Medicine*, 10, 952-960, 2018.
7. S. S. Motsa, Ch. Ramreddy and **Ch. Venkata Rao**, Non-similarity solution for Soret effect on natural convection over the vertical frustum of a cone in a nanofluid using new bivariate pseudo-spectral local linearisation method, *Applied Mathematics and Computation*, 314, 439-455, 2017. (Indexed in SCI, Scopus).
8. Ch. Ramreddy and **Ch. Venkata Rao**, Bivariate Pseudo-Spectral Local Linearisation Method for Mixed Convective Flow Over the Vertical Frustum of a Cone in a Nanofluid with Soret and Viscous Dissipation Effects, *Journal of Mechanics*, 1-16, 2017. (Indexed in SCIE, Scopus).
9. Ch. Ramreddy and **Ch. Venkata Rao**, Bivariate Pseudo-Spectral Local Linearisation Approach for the Soret and Viscous Dissipation Effects on Natural Convective Flow of Buongiorno Nanofluid Model Over Vertical Frustum of a Cone, *Journal of Nanofluids*, 6(3), 530-540, 2017. (Indexed in Emerging Sources Citation Index, Scopus).
10. Ch. Ramreddy and **Ch. Venkata Rao**, Double dispersion effects on non-Darcy free convective boundary layer flow of a nanofluid over vertical frustum of a cone with convective boundary condition, *Nonlinear Engineering*, 6(4), 277-292, 2017. (Indexed in Scopus).

11. Ch. Ramreddy and **Ch. Venkata Rao**, Double Stratification Effects on Mixed Convection Boundary Layer Flow of a Nanofluid Over Vertical Frustum of a Cone: A Darcy-Forchheimer Model, *Journal of Nanofluids*, 6(5), 971-981, 2017. (Indexed in Emerging Sources Citation Index, Scopus).
12. Ch. Ramreddy and **Ch. Venkata Rao**, Non-similarity Solutions for Natural Convective Flow of a Nanofluid Over Vertical Frustum of a Cone Embedded in a Doubly Stratified Non-Darcy Porous Medium, *International Journal of Applied and Computational Mathematics*, 1-15, 2017. (Indexed in Mathematical Reviews).
13. Ch. Ramreddy and **Ch. Venkata Rao**, A new numerical approach for Soret effect on mixed convective boundary layer flow of a nanofluid over vertical frustum of a cone, *International Journal of Pure and Applied Mathematics*, 113(8), 73-81, 2017. (Indexed in Scopus).
14. Ch. RamReddy, O. Surender, **Ch. Venkata Rao** and T. Pradeepa, Adomian Decomposition Method for Hall and Ion-Slip Effects on Mixed Convection Flow of a Chemically Reacting Newtonian Fluid Between Parallel Plates with Heat Generation/Absorption. *Propulsion and Power Research*, 6(4), 296-306, 2017. (Indexed in Scopus).
15. Ch. RamReddy, O. Surender, and **Ch. Venkata Rao**, Effects of Soret, Hall and Ion-slip on mixed convection in an electrically conducting Casson fluid in a vertical channel. *Nonlinear Engineering: Modeling and Application*, 5(3), 167-175, 2016. (Indexed in Scopus).
16. Ch. RamReddy, T. Pradeepa, **Ch. Venkata Rao**, O. Surender, and M. Chitra, Analytical Solution of Mixed Convection Flow of a Newtonian Fluid Between Vertical Parallel Plates with Soret, Hall and Ion-Slip Effects: Adomian Decomposition Method. *International Journal of Applied and Computational Mathematics*, 1-14, 2015. (Indexed in Mathematical Reviews).
17. Ch. RamReddy, **Ch. Venkata Rao** and O. Surender, Soret, Joule heating and Hall effects on free convection in a Casson fluid saturated porous medium in a vertical channel in the presence of viscous dissipation. *Procedia Engineering*, 127, 1219-1226, 2015. (Indexed in Scopus).

Communicated Papers:

1. "Bivariate pseudo-spectral local linearisation method for non-Darcy mixed convection flow of a nanofluid over vertical frustum of a cone with Biot number and double dispersion effects", Communicated to *Heat Transfer Research*.
2. "Nonlinear Boussinesq Approximation for Mixed Convective Flow of a Nanofluid over the Permeable Wavy Frustum of a Cone with Convective Boundary Condition", Communicated to *International Journal of Numerical Methods for Heat & Fluid Flow*.
3. "Non-similarity solution for natural convective flow of a nanofluid over the vertically rotating frustum of a permeable cone with convective boundary condition", Communicated to *Sadhana-Academy Proceedings in Engineering Sciences*.
4. "Mixed convective flow of a nanofluid over the vertically rotating frustum of a permeable cone with convective boundary condition: A non-similarity solution", Communicated to *Meccanica*.

Workshops/STTPs/GIANs/FDPs Attended:

1. Two Days International Workshop on “**Numerical and Analytical Techniques in Engineering Problems**”, Organized by Department of Mathematics, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu, during 12-13 November, 2020.
2. One Week Online Workshop on “**Numerical Linear Algebra**”, Organized by Department of Mathematics, Assam University, Silchar, Assam, during 19-25 September, 2020, sponsored by UGC under SAP(DRS-II).
3. One Day International Webinar on “**Recent Advances of Operations Research in Natural and Social Sciences**”, Jointly Organized by Department of Mathematics and IQAC, Lanka Mahavidyalaya, Assam, and Department of Mathematics, Assam University, Silchar, Assam, on 18th September, 2020.
4. Five Days International Webinar on “**Design and Applications of Single and Multi-Objective Optimization**”, Organized by Department of Mathematics, Assam University, Silchar, Assam, during 7-11 September, 2020, sponsored by UGC under SAP(DRS-II).
5. One Week Online Workshop on “**Algebraic Number Theory**”, Organized by Department of Mathematics, Assam University, Silchar, Assam, from 31st August to 5th September, 2020, sponsored by UGC under SAP(DRS-II).
6. Ten Days Online Webinar on “**An Introductory Course on Fluid Dynamics**”, Organized by Department of Mathematics, CHRIST (Deemed to be University), Bangalore, Karnataka, during 17-20 August and 24-28 August 2020.
7. One Week International Online Faculty Development Programme on “**Applications of Mathematics in Science & Engineering**”, Organized by the Department of Basic Science (Mathematics), Vishnu Institute of Technology, Bhimavaram, Andhra Pradesh, during 7-11 July, 2020.
8. Four Days National Webinar on “**Fluid Mechanics and its Applications in Engineering Science**”, Organized by Department of Mathematics, PES Institute of Technology and Management, Shivamogga, Karnataka, during 24-27 June, 2020.
9. One Day National Webinar on “**Fluid Dynamics**”, Organized by the Department of Mathematics and Statistics, School of Basic Sciences, Manipal University, Jaipur, Rajasthan on 23rd June, 2020.
10. One Week Online Faculty Development Programme on “**Mathematical and Statistical Modelling**”, Organized by Department of Humanities and Basic Sciences, Godavari Institute of Technology (Autonomous), Rajahmundry, Andhra Pradesh, during 26-30 May, 2020.
11. One Week Faculty Development Programme on “**Scientific Computations with Python**”, Organized by E & ICT Academy, National Institute of Technology, Warangal, Telangana, during 20-25 November, 2018.

12. Ten Days GIAN Course on “**Separation and Instabilities in High Speed Flows**”, Organized by Department of Mathematics, National Institute of Technology, Warangal, Telangana, during 6-17 August, 2018.
13. Ten Days GIAN Course on “**Spectral Methods for Solving Systems of ODEs and PDEs**”, Organized by Department of Mathematics, National Institute of Technology, Mizoram, during 20-29 June, 2016.
14. Five Days Short Term Training Programm on “**Contemporary Approaches of Applied mathematics in Science & Engineering**”, Organized by Department of Mathematics, National Institute of Technology, Warangal, Telangana, during 11-15 May, 2015.
15. Three Days Short Term Training Program on “**Advanced Numerical Methods in Fluid Dynamics**”, Organized by Department of Mathematics, National Institute of Technology, Warangal, Telangana, during 17-19 April, 2015.
16. Three Days Short Term Training Program on “**Advanced Computational Methods in Engineering & Science**”, Organized by Department of Mathematics, National Institute of Technology, Warangal, Telangana, during 1-3 April, 2015.
17. One Day National Workshop on “**New Paradigms of Mathematical Modelling and its Applications to Engineering & Technology**”, Organized by Department of Basic Science and Humanities, JNTUK University College of Engineering, Vizianagaram, Andhra Pradesh on 27th march, 2014.
18. Two Days National Workshop on “**Mathematical Applications of Engineering Disciplines**”, Organized by Department of Mathematics, Aditya Institute of technology and management, Srikakulam, Andhra Pradesh, during 4-5 Feb, 2013.
19. Two Days National Workshop on “**Mathematical Techniques and their Application to Engineering Problems (WOMTECH-12)**”, Organized by Department of Mathematics, MVGR College of Engineering, Vizianagaram, Andhra Pradesh, during 25-26 May, 2012.
20. One Day National Seminar on “**Algebra & Analysis**”, Organized by Department of Mathematics, Pondicherry University, Puducherry on 14th march, 2008.

Conferences Attended:

1. Presented a paper entitled “Double-Diffusive Natural Convective Flow of a Nanofluid past an Inclined Wavy Plate in a Non-Darcy Porous Medium” in **National Conference on Computational Modeling of Fluid Dynamics Problems (CMFDP-2019)** at **National Institute of Technology, Warangal**, during 18-20 January, 2019.
2. Presented a paper entitled “Non-Similarity Analysis for Nonlinear Convective Flow of a Nanofluid over the Permeable Wavy Frustum of a Cone with Convective Boundary Condition” in **National Conference on Mathematical Modelling in Science and Engineering** at **National Institute of Technology, Warangal**, during 27-28 March, 2018.

3. Presented a paper entitled “Natural Convective Flow of a Radiative Nanofluid past an Inclined Plate in a Non-Darcy Porous Medium with Lateral Mass Flux” in **International Conference on Numerical Heat Transfer and Fluid Flow** at **National Institute of Technology, Warangal**, during 19-21 January, 2018.
4. Presented a paper entitled “A new numerical approach for Soret effect on mixed convective boundary layer flow of a nanofluid over vertical frustum of a cone” in **9th National Conference on Mathematical Techniques and Applications** at **SRM University, Chennai**, during 27-28 January, 2017.
5. Presented a paper entitled “Non-Similarity Solution for Soret Effect on Natural Convection over a Vertical Frustum of a Cone in a Nanofluid using New Bivariate Pseudo-Spectral Linearisation Method” in **60th Congress (an International Conference) of Indian Society of Theoretical and Applied Mechanics** at **Malaviya National Institute of Technology, Jaipur**, during 16-19 December, 2015.
6. Presented a paper entitled “Soret, Joule Heating and Hall Effects on Free Convection in a Casson Fluid Saturated Porous Medium in a Vertical Channel in the Presence of Viscous Dissipation” in **International Conference on Computational Heat and Mass Transfer-2015** at **National Institute of Technology, Warangal**, during November 30 - December 2, 2015.

Proficiencies and Skills:

- MATLAB, Mathematica, Latex.

Awards and Fellowships:

- Received a **Best Paper Award** for “Natural Convective Flow of a Radiative Nanofluid past an Inclined Plate in a Non-Darcy Porous Medium with Lateral Mass Flux”, in **International Conference on Numerical Heat Transfer and Fluid Flow** at **National Institute of Technology, Warangal**, during 19-21 January, 2018.
- SRF Fellowship (2016-2018): Senior Research Fellowship, MHRD, India.
- JRF Fellowship (2014-2016): Junior Research Fellowship, MHRD, India.

Research Plan for Next 5 Years:

During my Ph.D. at National Institute of Technology-Warangal, I worked on the steady state boundary-layer flows of a Nanofluid with heat and mass transfer over the vertical frustum of a cone. Mostly the research was focused on Nanofluid behavior due to various physical effects and boundary conditions. Due to the convection mechanism, there is an instant change taking place in the fluid patterns. The investigation addresses these effects and tries to capture through graphs. The problems are formulated by constructing the suitable reduced form of Navier-Stokes equations along with the suitable boundary conditions. Finally,

the non-similarity solutions were found by employing Pseudo-Spectral Collocation Method along with local linearization procedure.

In the stability analysis of fluid flow problems, infinitesimal perturbations are imposed on basic state (equilibrium) of a flow system and it is identified whether the equations of motion offers that the perturbations should decay or grow. Mainly, the stability analysis is of two types: (i) linear stability analysis, (ii) non-linear stability analysis. In the problem of linear stability analysis, the stability of fluid flow w.r.t. the infinitesimally small perturbations and ignore the terms which are of second or higher order in the perturbation quantity and their derivatives from the perturbation equations. The linear instability analysis is also useful in providing various results in several stability problems which are almost agreement with the experimental predictions. In the linear instability analysis, we examine the initial behaviour of the disturbances whereas one has to solve a system of non-linear partial differential equations in the non-linear instability analysis.

A nanofluid is a term initially used by Choi in 1995 and refers to a base fluid with suspended solid nanoparticles in it. The thermal conductivity of nanometer sized particles is typically in the order of magnitude higher than those of the base fluids. The addition of nanoparticles to the base fluid even at low volume concentrations, results in significant increases in thermal performance. The goal of nanofluids is to achieve the highest possible thermal properties at the smallest possible concentrations (preferably $< 1\%$ by volume) by uniform dispersion and stable suspension of nanoparticles (preferably $< 10\text{nm}$) in host fluids. During the past decade the study of nanofluids has attracted immense enthusiasm from researchers in view of its exceptional applications in electronics, communication, computing technologies, high-power X-rays, medicine, lasers, optical devices, scientific measurement, material processing and material synthesis. Nanofluids are promising fluids for heat transfer enhancement due to their anomalously high thermal conductivity.

Ferrofluids (also called magnetic fluids) are colloidal suspension of subdomain magnetic particles, coated with a layer of surfactant in liquid carrier. In the presence of magnetic field a magnetic gradient is set up which affects the flow field. In certain cases the magnetization and the intensity of the field prevent instability, resulting in the increases in operating range of equilibrium flow field while in some other cases magnetization and intensity favor instability and thus change the fluid configuration. The knowledge of the effect of magnetic field and the response of the magnetic fluid is very much beneficial to the experimentalists.

In the coming years, I am interested to work on the study of various types of instabilities arising in the fluid flow of Nanofluids and Ferrofluids:

- Thermal Convection (or Benard Problem)
- Thermohaline Instability (or DoubleDiffusive Convection)
- Themo-magnetic convection
- Taylor-Couette flow instability
- Heated Plane Couette flow
- Heated Poiseuille flow instability

References:

1. Dr. Ch. Ramreddy,
Assistant Professor,
Department of Mathematics,
National Institute of Technology-Warangal.
Email: chittetiram@gmail.com
2. Dr. D. Srinivasacharya,
Professor,
Department of Mathematics,
National Institute of Technology-Warangal.
Email: dsc@nitw.ac.in
3. Dr. P V S N Murthy,
Professor,
Department of Mathematics,
Indian Institute of Technology-Kharagpur,
Email: pvsnm@maths.iitkgp.ernet.in
4. Dr. P A Lakshmi Narayana,
Associate Professor,
Department of Mathematics,
Indian Institute of Technology-Hyderabad,
Email: ananth@math.iith.ac.in