VINOD KUMAR BALAKRISHNAN

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PhD in Mechanical Engineering, specializing in transport phenomenon of polymer jets forming non-woven textiles, focusing on fluid and airflows in textiles and porous media production. Expertise in wind tunnel testing of airfoils, viscoelastic-fluid dynamics, and manufacturing of polymer composites, proficient in FEA and CFD Tools, with a Strong Record in innovative research, technical proficiency.

AREAS OF INTEREST

- Theoretical and Computational Fluid Dynamics and Heat Transfer
- Wind tunnel testing of airfoils.
- Multi-phase and Multi-Component Flow Through Porous Media
- Viscoelastic Wave Propagation in Liquid Jets and Films
- Rheological Behavior of Polymeric Liquid Jets and Droplet Dynamics
- Micro / Nano - Scale Nonwoven Manufacturing Processes
- Time Series Analysis and Smoothed Particle Hydrodynamics (SPH) framework
- Composite manufacturing processes (VARTM and RFI technique).
- Nonwoven textiles.

EDUCATION

Ph.D., Mechanical and Industrial Engineering | University of Illinois at Chicago 2019 – 2024

- **Specialization:** Dynamics of turbulent polymer jets.
- **PhD Thesis Title:** Probability of jet roping at smaller inter-nozzle distances for melt-blowing process.
  Advisor: Prof. Alexander L Yarin

Master of Engineering., Aeronautical Engineering | Hindustan University | Chennai, India 2007-2010

- **Specialization:** Characterization of fiber reinforced composites.
- **Master Thesis Title:** Life prediction of composite pipes using acoustic emission technique.
  Advisor: Dr. Dalbir Singh

Bachelor of Technology., Mechanical Engineering | University of Kerala | Trivandrum, India 2001-2006

TECHNICAL & COMPUTER SKILLS

- **Coding/Programming Language:** MATLAB, FORTRAN 77/90/95
- **Mechanical Design:** ANSYS(CFD), SolidWorks, Catia, Unigraphics, Pro-E, Hypermesh, Fluent and Gambit
- **Aerospace:** Wind tunnel testing, Aero-Engine testing, Airframe Repair and Maintenance, Aircraft systems
- **Data/image Processing:** High speed imaging, particle image velocimetry, Origin Pro, ImageJ, MS Office
- **Manufacturing:** Melt-blowing, Solution blowing and Electrospinning, Non-woven textiles, Vacuum assisted resin transfer molding, Resin Film Infusion, 3-D Printing.
- **Material Characterization:** SEM, Rheometers, DSC, DMA, Universal Testing machines, XRD.
- **Linguistic skills:** English, Malayalam, Hindi, Tamil, Sanskrit.

PROFESSIONAL EXPERIENCE

University of Illinois at Chicago Chicago, USA
Research Assistant Aug. 2019 – May. 2024

- **MATLAB** - Polymeric rheological behavior for nonwoven industry applications.
- **FORTRAN** - Simulating turbulent polymer melt jets with developed In-house numerical code.
- **FORTRAN** - Developed algorithms for modeling jet roping process with quasi-steady-state liquid jet dynamics.
- **MATLAB** - Estimation of architecture, porosity, and permeability of fibrous porous media.
- **MATLAB** - Developed algorithms for generating 3D fiber web laydown.
- **Mechanical Characterization**- High speed imaging of flow of polymer jet in an environment of turbulent air.
- **SOLID WORKS**-Designed and fabricated solution blowing dies using 3D printing.
- **STATISTICAL ANALYSIS**- Developed novel statistical methods to quantify roping in a fiber mat.
- **Design of experiments** (DOE) for visualizing roping in flight.

KCG College of Technology Chennai, India
Assistant Professor Jul. 2017 – Apr. 2019
Jul. 2011 – Dec. 2014

- Developed a Smart Load-Bearing Structure to Enhance UAV Operational Range by 5%, involving the manufacture of Piezo-fiber Composite (PFC) embedded wingspan and utilization of PFC sensors for data analysis.
- CFD Simulations using Ansys (Fluent), and experiments (wind tunnel) were conducted on NACA 0012 with sinusoidal LE airfoils undergoing stall.
- Guided undergraduate students through final year projects and supported the development of their research, engineering, and academic writing skills. Received Rs.1M ($12000) research grant.

Anna University Chennai, India
Research Associate Jan. 2015 – Jun. 2017

- Enhanced structural health monitoring capabilities by employing electrospinning to integrate nano piezoelectric fibers into glass-fiber composites, achieving a 50% improvement in the detection of microcracks.
- Manufactured fiber reinforced composites using Vacuum assisted resin transfer molding (VARTM) and Resin Film Infusion technique for sonar dome used in navy.
- Developed and tested fiber reinforced polymer microvascular composites for flexural testing in accordance with ASTM standards for the purpose of self-healing structural applications, revealing a 20% reduction in flexural strength compared to virgin fiber reinforced polymer composites.
- Provided guidance to new researchers through all stages of the research process, from conceptualization to publication, and coached them on securing external funding.

Gojan School of Business and Technology Chennai, India
Lecturer May 2010 – Apr. 2011

- Fostered student success by providing personalized mentorship and instruction in key engineering subjects, including Fluid Mechanics, Dynamics of Machinery, Manufacturing Processes, Aircraft Systems, and more, resulting in a 20-50% improvement in pass rates.

TALKS AND PRESENTATIONS

- **V.K. Balakrishnan**, A. L. Yarin, B. Pourdeyhimi, "Probability of jet roping at smaller inter-nozzle distances for melt-blowing process.", Bi-annual industrial board research review meetings at The Nonwoven Institute. Rayleigh, North Carolina (2019, November – 2022, November).

FACULTY AND STUDENT DEVELOPMENT PROGRAMS

- Advance course on, "Materials and Electro-Mechanical and Biomedical Devices Based on Nanofibers" conducted by **Centre International des Sciences Mécaniques,** Udine, Italy.
- FDP on "Smart Materials and Systems" conducted by Department of Instrumentation and Control Engineering, **NIT Trichirappalli**.
- Two-week ISTE workshop on "Engineering Thermodynamics" conducted by **IIT Bombay**.
- Attended "Regional Training Program On URKUND- An Anti-Plagiarism Detection tool" conducted at **Anna University**, Chennai.
- FDP on "Dynamic Response of Advanced Composites" conducted by Department of Mechanical Engineering, **NIT Surathkal**.

PUBLICATIONS

- **V K Balakrishnan**, B. Pourdeyhimi, A L Yarin, "Numerical investigation of roping in multi-die meltblowing" Journal of Applied Physics. 2024. (In-preparation)
- **V K Balakrishnan**, B. Pourdeyhimi, A L Yarin, "Effect of inter-needle distance on jet roping and laydown structure in solution blowing" Journal of Applied Physics. 2022; 132; 184903.
- **V K Balakrishnan**, B. Pourdeyhimi, A L Yarin, "Probability of jet roping in solution blowing of multiple jets" Journal of Applied Polymer Science 2023; 140 (30); e54086.
- **B Vinod Kumar**, A. Raveendran, V. Davis, "Optimization of Piezo-fibre Composite with IDE Embedded in a Multilayer Glass Fibre Composite"; Procedia Materials Science 2014; 6: 1207 – 1216.

PERSONAL DETAILS

Date of Birth	:	28th April 1984
Gender	:	Male
Nationality	:	INDIAN
Marital Status	:	Married
Spouse Name	:	Aparna K.
Permanent Address	:	Vineetha Nivas, I.R.Lane - 18 Mannamoola, Peroorkada Trivandrum-695 005 Kerala, India
Languages known	:	English, Hindi, Malayalam, Tamil