



Sandeep Kumar

Professor –Mechanical Engineering Department, Indian Institute of Technology (BHU),
Varanasi, India

E-mail: sandeep.mec@iitbhu.ac.in

Phone no: +91-9452761925

Academic Background:

Educational Qualifications:

S.N.	Degree (Specialization)	Institute/University
1	Ph.D. (Applied Mechanics)	India Institute of Technology, Delhi.
2	M.Tech. (Machine Design)	Institute of Technology, BHU, Varanasi
3	B.E. (Mechanical Engineering)	M.N.R.E.C. Allahabad.

Ph.D. Thesis Title: Some Studies in Static and Dynamic Response of Thick Laminated Polar Orthotropic Circular Plates and Shallow Spherical Shells.

Supervisor: **Prof. Y. Nath**, Applied Mechanics Department, IIT Delhi.

Professional Experience:

S.No.	Institute/ University	Post	Period
1	Shiv Nadar University, Gautam Budh Nagar, India	Professor & Head (On leave from BHU)	Feb 2014 – Dec 2014
2	I.T., B.H.U., Varanasi, India	Reader/Assoc. Prof	27.12.2004-Feb 2011
3	A.I.M.S.T., Sg. Petani, Malaysia	Assistant Professor	19.9.2002 - 22.12.2004
4	B.I.T.S. Pilani, India	Assistant Professor	1.8.1998 – 15.9.2002
5	R.E.C. Kururkshetra, India	Lecturer	30.8 1994 – 31.7.1998

Teaching

We developed a postgraduate mathematics courses for students pursuing degree in engineering at IIT(BHU). The course covers functional analysis, an important area of mathematics which is very useful for study of ordinary and partial differential equations, numerical methods, calculus of variation and linear algebra with emphasis on engineering applications. The intent is a) to excite their interest in the abstract mathematics which is necessary to understand higher level of mathematics. b) to introduce relevant mathematics to understand the concepts of advanced finite element method and wavelets.

At undergraduate level, I shall love to teach courses in the areas of design, particularly product design with hands on experiences in product definition, conceptual design, detail design, and prototype creation. I believe that the present system of education does not bring the experience of creation instudents. This hands-on synthesis of design, prototype building, presentation and criticism will create superior engineers.

Courses Taught at IIT, BHU:

Computer Aided Design (Odd Semester)
Mathematical Methods & Optimization, M.Tech. I Sem., (Odd Semester)
Finite Element Method, M.Tech. II Sem. (Even Semester)
CAD –Lab, B.Tech. VII Sem. (Odd Semester)
Engineering Drawing, B.Tech. II Sem.
Workshop Practice B.Tech. I & II Sem.
Strength of Materials, B.Tech II Sem. in 2010
Machine Design I, B.Tech. IV Sem. in 2008-09
Engineering Mechanics, B.Tech. II Sem. in 2004-05

Courses Taught at AIMST, Malaysia:

Mathematics to IT students
(Developed course content and first year labs for approval of mechanical engineering programme)

Courses Taught at BITS Pilani:

Product Design
Computer Aided Design
Machine Design
Nondestructive Testing Techniques
Kinematics of Machine
Thermodynamics

Courses Taught at REC(NIT)Kurukshetra:

Strength of Material
Engineering Mechanics
(Fortran) Computer Programming

Power Plant
Mechanical Measurement

Research Interests:

The broad area of my research interest is to develop mathematical models and advanced computational algorithms for the design and analysis of complex systems in mechanical engineering. In my PhD work, Chebyshev polynomial based efficient numerical solution method was developed to solve nonlinear coupled partial differential equations (PDEs) that arise in composite plates and shells. After my PhD work, my focus has shifted to new emerging and exciting numerical techniques such as element free Galerkin method and radial basis function. I have also developed mathematical model for roller bearing to study the nonlinear dynamics and chaotic phenomenon. At present, I am involved in wavelet based techniques to solve problems that are computationally very expensive to solve by the most versatile PDEs solver, i.e. finite element method. Specific areas of interest include:

- Wavelet based Method for Advection-Dispersion Equation
- Multi-scale Modeling and Estimation of Numerical Error
- Large Deformation Analysis with Contact
- Finite Element with Scale Orthogonal Wavelets
- Prediction of Wear using Wavelets
- Modeling of Lamb Wave using Wavelets

Research Projects & Summary:

- **Study of Tool Wear in Diamond Turn Machining & Micro Machining Processes and Development of Tool Wear Monitoring & Compensation Methodology to Enhance the Size & Shape Accuracies of the Ultra Precision Machined Components.** (Principal Investigator)(MoU with BARC 2013-2015 : 24 Lakhs)

The objective of the project is analysis of vibration using wavelet transform for

- Tool condition monitoring (to identify online tool wear and breakage)
- Finding effects on surface roughness
- Find the factors such as spindle speed, feed rate, cutting depth, rake angle and shear angle which effect vibration.
- **Wavelets and their Applications in Computational Mechanics**, *Department of Science & Technology, India.* (Principal Investigator)(10 Lakhs: 2007-2010) *Project Completed*

Finite element method, the most widely used numerical technique to solve engineering problems of complex domains, depends on the adaptive grid generation to account the localized changes in the domain. Re-computing of stiffness matrix in adaptive grid technique is a time consuming process. We are incorporating wavelet based technique in the finite element method which

compresses the stiffness matrix of finite element, eliminates re-computing process, and works as preconditioning in iterative solution of FE equations.

- **Numerical Solution of Advection Dispersion Equation using Wavelets**, *Board of Research in Nuclear Sciences, DAE, India*. (Principal Investigator)(**13 Lakhs: 2008-2011**)
Project Completed

Operation of any nuclear power plant releases gaseous and liquid effluent in the environment. In order to know the impact of the effluent release on the environment, mathematical model is very useful. Basic aim in this issue is to compute the concentration of a pollutant at any spatial grid/mesh point and at any instant of time within the domain of interest. The difficulty in mathematical modeling is in the solution due to very low coercive constant compared to continuity constant. In this project, we are developing efficient and accurate wavelet based numerical techniques for solution of advection dispersion equation.

Invited Lectures:

- “Customized Scale Orthogonal Wavelets for Solution of PDEs”, BARC-BRNS Theme Meeting, **Homi Bhabha National Institute, Mumbai**, June 16-17, 2015
- “Lectures on Wavelets”, Advanced Training Programme on Integral Transform, Wavelets, Distribution Theory and Applications, **DST-CIMS, BHU**, July 12-21, 2012
- “Error Estimation and Adaptive Mesh in Finite Element Method”, **Department of Mechanical & Industrial Engineering, I.I.T. Roorkee**, July 12-16, 2010
- “Scale-orthogonal wavelets”, **Bhabha Atomic Research Centre, Mumbai**, March 5-6, 2010
- “Time-Frequency Analysis and Denoising of Signals using Wavelets”, **Department of Mechanical & Industrial Engineering, I.I.T. Roorkee**, July 6-10, 2009
- “Lifting Scheme and Second Generation Wavelets”, **Department of Mathematics, B.H.U. Varanasi**, 22 Oct-5 Nov, 2008.

Administrative Positions:

- Professor & Head – Mech..Engg. Dept., Shiv Nadar University, Gautam Budh Nagar, India Feb 2014-Dec 2014
- Convener Departmental Post Graduate Committee (DPGC), Department of Mechanical Engineering, Sept 2012- Jan 2014
- Treasurer , Gymkhana, IIT (BHU), Nov 2012- Jan 2014
- Member , Senate Library Committee, Dec. 2012- Jan 2014
- Member, Cafeteria Management Committee, Nov 2012- Jan 2014
- Administrative Warden, Dr. C. V. Raman Hostel, From June 2006 -Aug 2009.
- In-charge CAD lab, Since July 2005.

- Organized workshop “ATOM FOR PEACE” with Indian Association of Radiation Protection on Aug 18-19, 2008. More than 2000 students from BHU and school/ colleges of Varanasi, participated.
- In-charge, Practice School Division1, BITS Pilani, 2001-2002

Selected Papers in Conferences:

- Adaptive Grid Selection in Finite Element Method using Wavelets”, *Int. Conference on Computational & Experimental Engineering and Sciences – 28 March– 1 April, 2010, Las Vegas, U.S.A.*
- B-Spline in Multilevel Wavelet Galerkin Solution of One Dimensional Problem” ,^{3rd} *Int. Congress on Computational Mechanics & Simulation, 1-5 Dec 2009, IIT Mumbai.*
- Wavelet-Galerkin Method for Some Elasto-Statics Problems”, *Int. Conference on Modeling of Engineering & Technological Problems*www.siam-india.org14-16 Jan 2009, *B.M.A.S.E.C., Agra.*
- Numerical Solution of One Dimensional Partial Differential Equations using Moving Least Square Based Wavelets”, *IV National Conference on Applicable Mathematics in Wave Mechanics and Vibration 14-16 Nov., 2008, J.E.C.R.C.Jaipur.*
- Siddavatam Rajesh, K. Sandeep and R.K.Mittal,(2007). “A Fast Progressive Image Sampling using Lifting Scheme and Non-Uniform B-splines,” in *Proceedings of IEEE International Symposium on Industrial Electronics, (ISIE-07) in Vigo, SPAIN, June 4-7.*
- Siddavatam Rajesh, **K. Sandeep**, R.K. Mittal, “Robot Motion Planning on Rough Terrain Using Multiresolution Second Generation Wavelets and Non-Uniform B-splines”, *IEEE Conference on Industrial Technology, 2006, IIT Mumbai*
- B. Pradhan, S. Mansor, A.R. Ramli, A.R. MohmedSharrif, **K. Sandeep**, “LIDAR data compression using wavelets”, *Remote Sensing – SPIE Europe International Symposium, 5983-05, 19-22 September 2005, Belgium*
- Presented one hours talk on “Application on Second Generation Wavelets in Geographical Terrain Representation”, *Wavelet Workshop – Theory and Applications, April 26-May 7, 2004, University of Prince Edward Island, Canada.*
- Participated in the international conference on *Wavelets Theory and Applications: New Directions and Challenges, Aug 10-13, 2004, National University of Singapore.*

Publications in International Journals:

- S.M. Quraishi, and K. **Sandeep**, (2013). Multiscale modeling of beam and plates using customized second-generation wavelets. *Journal of Engineering Mathematics*, 1-18.(DOI 10.1007/s10665-012-9579-4)
- Radha Krishna Lal, Vikas Kumar Chaudhary, J.P. Dwivedi, V.P. Singh and **Sandeep Kumar** (2013) “Springback Analysis of Rectangular Sectional Bar of Non-linear Work Hardening Materials under Torsional Loading”, *Applied Mechanics and Materials*, Vol 393, pp 422-434.
- **K. Sandeep**, Shikha Gaur, D. Dutta and H.S. Kushwaha, (2011), Wavelet based schemes for linear advection-dispersion equation, *Applied Mathematics and Computations*. Vol. 218, n 7, pp 3786-3798.
- S.M. Quraishi and **K. Sandeep**, (2011), A Second Generation Wavelet based Finite Element on Triangulation, *Computational Mechanics*. Springer, Vol.48, pp 163-174.
- **K. Sandeep** and Kamal Kumar K, (2009), Use of B-Spline Function in Element Free Galerkin Method for Numerical Solution of Partial Differential Equation, *Int. J. of Computational Methods*, Vol 6, n 3, pp. 1-12.
- S.M. Quraishi, R Gupta and **K. Sandeep**, (2009) Adaptive Wavelet Galerkin Solution of Some Elastostatics Problems on Irregular Spaced Nodes, *The Open Numerical Methods Journal*, Vol 1, pp 20-25.
- R. K. Misra, S. Kumar, **K. Sandeep** and Ashok Misra, (2008) Dynamic Analysis of Banana Fibre Reinforced Low Density Polyethylene/ poly (ε-caprolactone) Composites, *J. of Mechanics of Materials and Structures*, Vol 3, n. 1, pp 107-125.
- R. K. Misra., Sandeep Kumar, **K. Sandeep** and Ashok Misra, (2008) Some Experimental and Theoretical Investigations on Fire Retardant Coir/Epoxy Micro-Composition, *J. of Thermoplastic Composite Material*, Vol. 21, n. 1, pp 71-101.
- R.K. Misra, **K. Sandeep** and Ashok Misra, (2007) Analysis of Laminates using Multiquadric Radial Basis Function, *Int. J. of Computational Methods in Engineering Science and Mechanics*, Vol 8, n. 5, pp 303-312.
- B. Pradhan, **K. Sandeep**, S. Mansor, A. R. Ramli and A. R. B. M. Sharif, (2007), Second Generation Wavelet Based GIS Terrain Data Compression Using Delaunay Triangulation, *Engineering Computations (Emerald)*, Vol. 24, n. 2 pp. 200-213.
- R.K. Misra, **K. Sandeep** and Ashok Misra, (2007) Analysis of Anisotropic Plate using Multiquadric Radial Basis Function, *Engineering Analysis with Boundary Elements*, Vol. 31, pp. 28-34.

- B. Pradhan, **K. Sandeep**, S Mansor, (2007) GIS Terrain Data Compression using Lifting Scheme- A New Direction, *Int. J. of the Computer, the Internet and Management*, Vol. 15, n. 3. pp. 9-19.
- B. Pradhan, **K.Sandeep**, S.Mansor,Abd. R Ramli and A. M.Rashid,(2006), “Spatial Data Compression and Denoising Via Wavelet Transformation”,*International Journal of e-GIS (Australia)* ,Vol. 2, no. 1.
- B. Pradhan, **K.Sandeep**, S.Mansor,Abd. R Ramli and A. M.Rashid,(2006), “A Fast Processing Algorithm for Remote Sensing Data Compression (LIDAR) Using Second Generation Wavelet”,*Korean Journal of Remote Sensing*, Vol. 22, no. 1 pp. 1-13.
- I. V. Singh, **K. Sandeep** and R. Prakash, (2005) “The effect of weight function and scaling parameter on meshless EFG results in heat transfer problems”, *International Journal of Heat &Technolog*,Vol 23, n. 1, pp. 13-20.
- S.P. Harsha, **K. Sandeep** and R. Prakash, (2004), “Nonlinear Dynamic Behaviors of Rolling Element Bearings Due to Surface Waviness”, *Journal of Sound and Vibration*. Vol 272, pp 557-580.
- I.V. Singh, **K. Sandeep** and R. Prakash, (2004), “Application of meshless element free Galerkin method in two-dimensional heat conduction problems”, *Computer Assisted Mechanics and Engineering Sciences*, Vol. 11, pp. 265-274.
- S.P. Harsha, **K. Sandeep** and R. Prakash (2004), “Nonlinear Dynamic Response of a Rotor Bearing System Due to Surface Waviness”, *Nonlinear Dynamics*, Vol 37, pp 91-114.
- I.V. Singh, **K. Sandeep** and R. Prakash, (2003), “Heat Transfer Analysis of Two-Dimensional Fins using Meshless Element-Free Galerkin Method”, *Numerical Heat Transfer: Part A*, Vol. 44, pp. 73-84.
- S.P. Harsha, **K. Sandeep** and R. Prakash, (2003), “The Effect of Speed of Balanced Rotor on Nonlinear Vibrations Associated With Ball Bearings”, *International Journal of Mechanical Sciences*, Vol.47, n. 4, pp. 225-240.
- S.P. Harsha, **K. Sandeep** and R. Prakash, (2003), “Effects of Preload and Number of Balls on Nonlinear Dynamic Behavior of Ball Bearing System”, *International Journal of Nonlinear Sciences and Numerical Simulation*, Vol. 4, n. 3, pp. 265-279.
- I.V. Singh, **K. Sandeep** and R. Prakash, (2003), “Meshless EFG method in transient heat conduction problems”, *International Journal of Heat & Technology*, Vol. 21(2), pp. 99-105.
- S. P. Harsha, **K. Sandeep** and R. Prakash, (2003), “Quasi-periodic, Subharmonic and Chaotic Motions of a Rotor Bearing System”, *International Journal of Nonlinear Sciences and Numerical Simulation*, Vol 4, n 3, pp 361-372.

- S.P. Harsha, **K. Sandeep** and R. Prakash, (2003), “Nonlinear Dynamic Behaviors of High Speed Rotor Supported By Rolling Element Bearings”, *International Journal of Applied Mechanics and Engineering*, Vol 8, n 4, pp 705-720.
- I. V. Singh, **K. Sandeep** and R. Prakash, (2002), “The Element Free Galerkin Method in Three-Dimensional Steady State Heat Conduction”, *International Journal of Computational Engineering Sciences*, Vol. 3, n. 3, pp. 291-303.
- Y. Nath and **K. Sandeep**, (2000), “Nonlinear Analysis of Doubly Curved Shells: An Analytical Approach”, *Sadhana*, Vol. 25, n. 4, pp. 343-352.
- **K. Sandeep** and Y. Nath, (2000), “Nonlinear Dynamic Response of Axisymmetric Thick Laminated Shallow Spherical Shells”, *International Journal of Nonlinear Science and Numerical Simulation*, Vol. 1, pp. 225-238.
- **K. Sandeep** and Y. Nath, (2000), “ Nonlinear Analysis of Unsymmetrically Laminated Moderately Thick Axisymmetric Structures”, *International Journal of Nonlinear Science and Numerical Simulation*, Vol. 1, pp. 215-223.
- Y. Nath and **K. Sandeep**, (1998), “Effect of Transverse Shear on Static and Dynamic Buckling of Antisymmetrically Laminated Polar Orthotropic Laminated Moderately Thick Axisymmetric Structures”, *Composite Structures*, Vol. 40, n. 1, pp. 67-72
- Y. Nath and **Sandeep Kumar**, (1995), “Chebyshev Series Solution to Nonlinear Boundary Value Problems in Rectangular Domain”, *Computer Methods in Applied Mechanics and Engineering*, Vol. 125, pp. 41-52.
- Y. Nath and **Sandeep Kumar**, (1995), “Large Amplitude Response of Layered Circular Plates”, *ASCE, Journal of Engineering Mechanics*, Vol 121, n 1, pp 37-49.
- Y. Nath and **K. Sandeep**, (1994), “The Stability of the Houbolt Time Marching Scheme in Nonlinear System”, *Journal of Sound and Vibrations*, Vol. 175, n. 4, pp. 565-569
- Y. Nath and **K. Sandeep**, (1993), “Postbuckling of Symmetrically Laminated Moderately Thick Axisymmetric Shallow Spherical Shells”, *International Journal of Mechanical Sciences*, Vol. 35, n. 11, pp. 965-975.

Ph.D. –3(Completed) and 2 (in progress), **M.Tech.16** completed at IIT (BHU)

- **Ms. Shikha Gaur** “Numerical Solution of Advection-Dispersion Equation using Wavelets” (as a co-supervisor) 2012
- **Mr. Sarosh M.Quraishi**“ Multiscale Analysis of Beams and Plates using Finite Elements with Customized Wavelets” 2011
- **Mr. Biswajeet Pradhan** “Compression of Three-Dimensional Terrain Data Using Lifting Scheme Based on Second Generation Wavelets” (as a co-supervisor) 2006

