

## Pradeep Kumar, PhD.

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### Summary

I have completed my **PhD. (Mechanical Engineering)** work from State-Of-The-Art research centre “Bhabha Atomic Research Centre (BARC), Mumbai, India” in the field of fracture mechanics, structural/solid mechanics, finite element analysis (FEA) and small punch test (SPT) technology through a prestigious fellowship award “DGFS-PhD” of DAE Govt. of India. I am results-oriented structural safety professional with 6 years of experience in government and privately held organizations. I have exposure of 10 years in ANSYS software (Academic & Commercial) & 5 years in BARC in-house FEA software “MADAM code” along with FEA theory and solid mechanics. I have proven track record in handling multiple projects of structural mechanics analysis, fracture mechanics and fatigue analysis, FE modeling, interpretation and validation of FE results. I have strong aptitude in research and development, providing consultancy services and leading of technical team members for new product development and remaining life estimation of existing products/components. I am very keen to deliver value and innovation in structural safety methodology.

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### Core competencies

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) Team Leader	) Fracture Mechanics	) FEA/Stress analysis
) Structural/solid Mechanics	) Solving challenging problems	) Fatigue & Damage Tolerant (F&DT)
) XFEM	) FEA code development	) Creep modeling
) Thermo-Mechanical stress Analysis	) Hypermesh software	) Non-linear material modeling
) Franc2D/3D software	) ANSYS Software	) APDL/Fortran90/95
) Static & Dynamic Analysis	) Elasto- plasticity material modeling	) Optimization
) Contact modeling		) Visco-elasticity material modeling
) CFD		

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### Professional Experiences in reputed organizations

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*I have gained professional experiences from reputed organizations in two categories (a) regular job (b) consultancy services. Here, I have mentioned these organizations where*

I have enjoyed solving different types of challenging problems with engineering judgment by understanding physics of the problems that come closest to reality.

**Note: I am very keen to solve the challenging problems of mechanical engineering from diverse fields.**

### **Professional Experiences on Regular Appointments**

**Bhabha Atomic Research Centre, Mumbai, India**

**Aug 2012-Present**

*Pioneering and innovative R&D service provider for industrial establishments in India*

**Division-1:** Reactor Safety Division (RSD), Trombay

**Division-2:** Electron Beam Centre (EBC), Kharghar

**Research Engineer** (Mechanical Engineering)

Performing structural mechanics and fracture mechanics analysis to prevent structural failure of stationary and rotary components. Doing research to develop new correlations and methodologies to predict remaining life of mechanical structures.

**Small Projects:** The following projects are successfully executed.

1. Finite element analysis of different types of pre-cracked specimens viz. CT, TPB etc. using (a) Elasto-plastic material modeling (b) Damage mechanics material modeling to evaluate J-integral applied and material J-resistance data.
2. Fracture mechanics and structural analysis of primary heat treatment (PHT) straight pipes, elbows and branch tees of the 500 MWe Indian pressurised heavy water reactors (PHWRs).
3. Fracture mechanics and structural mechanics analysis of 500 MWe Indian PHWRs pressure vessel using FEA.
4. Damage mechanics analysis of small punch test specimens in a die punch assembly using FEA.
5. Design and FE analysis of mechanical seal for centrifugal pump used in Indian PHWRs and AHWRs.
6. Structural mechanics analysis of vertical linear accelerator tank under 10 bar pressure of SF6 gas using FEA and ASME code.
7. Structural mechanics analysis of storage tank under 8 bar pressure of SF6 gas using FEA and ASME code.
8. Structural mechanics analysis of hemispherical and torispherical pressure vessels using FEA and ASME code.
9. Design, analysis and optimization of various types of bellows/expansion joint for 10 bar pressure and 450 °C temperature using EJMA and FEA.
10. Structural mechanics analysis of different types of pressure vessel heads viz. hemispherical, torispherical, inverted torispherical and flat.

## Large Projects:

- ) Prediction of remaining mechanical and fracture properties of in-service RPV and nuclear piping systems without affecting structural integrity using small volume of materials.
- ) Structural integrity analysis and Prediction of remaining life of in-service RPV and nuclear piping systems under current operating conditions using API 579 codes and finite element analysis.
- ) Design and structural mechanics analysis of pressure vessels used in 100 kW DC Accelerator for waste water treatment using ASME codes and FE analysis.
- ) Thermo-mechanical analysis of electron gun using FEA and its results validation.
- ) Rigid modeling of die and punch for elasto-plastic analysis and damage modeling of cracked and un-cracked plates under frictional contact condition.
- ) Structural mechanics and fracture mechanics analysis of steam turbine rotor and stator systems for Indian PHWRs and AHWRs.

**Software used:** ANSYS workbench and classic, MADAM code (BARC in-house code).

**ANSYS commercial licensing:** Electron Beam Centre (EBC), Kharghar, Navi-Mumbai

**Codes & Standards:** ASME Section I, ASME Section-VIII Div.-1, 2 & 3, EJMA, ASTM E1820, API 579-1/ASME FFS-1, R6 method.

## Accomplishments:

- ) Developed new correlations to predict remaining mechanical and fracture properties of in-service RPV and nuclear piping systems without affecting structural integrity using small volume of materials.
- ) Hands on FEA experience in material fracture analysis, stress analysis, creep analysis and thermo-mechanical stress analysis of high temperature and pressure RPV, gas turbine, steam turbine, heating chambers, boilers, various types of nozzles and etc.
- ) Published interesting research work based on material fractures analysis, elasto-plastic material modeling and etc. in a high impact factor journals.
- ) R&D member of a technical team for structural safety and numerical computational.

**Sharda Group of Institutions, HCST, Mathura, India**

**Oct 2011-Aug 2012**

*Leading engineering education and Consultancy services organization*

**Assistant Professor (Automobile Engineering Department) at Mathura**

Research and teaching

**Accomplishments:**

- ) Taught design of machine & automobile elements, Finite element method (FEM) using ANSYS software, mechanics of materials. Guided engineering projects.
- ) Designed advanced syllabus for Finite element method (FEM) and Fluid machinery.

**ANSYS academic licensing:** Mechanical Engineering Department, HCST, Mathura

**MAHLE Filter Systems (India) Limited, India****June 2011-Sep 2011**

*Largest manufacturer and exporter of automotive and industrial filters in India*

**Engineer (Product Engineering) at Gurgaon**

Performed meshing, static and vibration analysis of different types of automotive filters

**Software used:** Hypermesh, Hyperworks

**Professional Experiences in Consultancy Services****Pegasys Systems Pvt. Ltd., Mumbai, India**

*India's No 1 Automatic Shaft Straightening Machine Manufacturer & Exporter*

**Engineering Consultant (Finite Element Analysis)**

Providing finite element analysis (FEA) consultancy services to prevent structural failure of shaft straightening machine by considering static, fatigue and buckling analysis conditions. To optimize the machine structure considering strength and rigidity criteria.

**Projects:** The following projects are successfully executed by me for this company.

1. Structural mechanics analysis of 25 tonne shaft straightening machine for 10-15 yrs. of safe operation.

**Accomplishments:**

- ) I had finalized the first project deal in one meeting only, due to my strong coordination with stakeholders and understanding their structural mechanics analysis requirements.
- ) On successful completion of the project, excellent feedback has been given on overall provided services like technical expertise, on time project completion, a good value of the project cost etc.
- ) I have performed stress analysis, buckling analysis and fatigue analysis of 25 tonne Automatic Shaft Straightening Machine.
- ) Approximately more than hundred parts are involved in assembly where I have used different types of contacts viz. bonded, frictionless etc. to simulate reality by understanding physics of the problem.

- ) Geometrical cleanup and CAD model simplifications viz. removing small holes and fillets and giving fillets to avoid singularity problem etc. have been performed without disturbing physics of the problem to simulate reality.
- ) I have performed hex meshing of all the parts of machine and reduced convergence cost due to my vast experience in meshing, element type and size selection.
- ) Based on interpretation of FEA results and engineering judgment, modifications cycles cost of FEA model of Automatic Shaft Straightening Machine has been reduced.
- ) The modifications and optimization has been suggested based on considering strength and rigidity criteria because deflection of the machine beds impacts on machine's reliability.

**Protton Engineering, Mumbai, India**

*A fast growing and rising company in the dynamic field of Piping Technology*

**Technical Team Leader/Manager** (Finite Element Analysis and CFD)

Providing technical assistance, training and leading/managing to an engineering analysis team for successful execution of projects related to FEA and CFD domains. Providing quotation of project and having coordination with stakeholders to understand their requirements on behalf of Protton Engineering.

**Projects:** The following projects are successfully executed under my leadership for this company.

1. Finite Element Analysis of Boot Nozzle and other types of nozzle.
2. Estimation of vortex shedding frequency under external flow to study the performance and safety of boiler.
3. Structural mechanics and fatigue analysis of miter bend, T-junction using FEA.
4. Structural mechanics and fatigue analysis of long pipe with multiple bend and stiffeners under internal high pressure and temperature as well as vacuum condition using FEA (multiple projects).
5. Stress intensification factor (SIF) calculation of various types of miter bend and T-junction using FEA.
6. FE analysis of pressure vessels with multiple nozzle loads under high pressure and temperature. (multiple projects)

**Accomplishments:**

- ) I establish coordination with stakeholders to understand their structural mechanics analysis requirements on behalf of Protton Engineering.
- ) Technical team leader of 4-5 engineering analysis team.
- ) I provide FEA, CFD and conventional subjects training to an engineering analysis team from time to time to enhance quality of team.

- ) Providing professional practice to technical team to handle complex problems on FE modeling and its results validation for different types of nozzle, pressure vessels, pump and steam & gas turbine components and other rotary components and piping systems etc.

**Codes & Standards:** ASME Section I,II, ASME Section VIII Div.-1 & 2

### **Others small organizations**

I have also provided corporate training and consultancy services to the following organizations in the past.

1. CADD Centre, Dadar, Mumbai, India
2. CADD Centre, CST, Mumbai, India
3. Matrix CAD Academy, Kharghar, Navi Mumbai, India

**Subject area of corporate training and consultancy services:** FEA and CFD

**Software used:** ANSYS workbench and classic

**ANSYS academic licensing:** Above mentioned organizations (List 1-3).

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### **Certification and Awards**

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- ) **Certificate of Expertise in ANSYS software** (Based on the evaluation of theoretical and application knowledge) by CADD Centre training & Services Pvt. Ltd.
- ) Awarded with a prestigious “**DGFS-PhD fellowship**” by Department of Atomic Energy (**DAE**) **Govt. of India** to solve structural failure issues.
- ) **Excellent Certificate for PhD. Research work** by BARC, Mumbai doctoral committee.

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### **Education**

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**Bhabha Atomic Research Centre**, Mumbai, India, PhD in **Mechanical Engineering**, (PhD. Thesis submitted in June 2017) ---- **Excellent Grade (By Doctoral committee)**

- ) Relevant coursework: Basic & advanced fracture mechanics (Theoretical and Computational), Fatigue analysis
- ) Published research work in SCI journals and involved in BARC projects

**National Institute of Technology (NIT)** Hamirpur, H.P, India, **M.Tech (Mechanical Engineering)**, July 2011 -----**8.85/10 CGPI (Hons.)**

- ) Relevant coursework: Linear & non-linear finite element method using ANSYS & Hypermesh software, Rapid prototyping & manufacturing, Product development & design, Optimization techniques, Bearing design, Industrial robotics
- ) Published research work in SCI journals and involved in engineering consultancy projects with M.Tech guide.

**Uttar Pradesh Technical University (UPTU)**, Lucknow, U.P, India, **B.Tech (Mechanical Engineering)**, Aug 2009 ---- 71.92% (**First Div.**)

- ) Relevant coursework: Strength of materials, Machine design, Heat transfer, Physics, Professional communication, Material science, Applied thermodynamics, Dynamics of machine, Fluid machinery

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#### **Latest Research work Publications in SCI Journals (peer reviewed)**

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1. **Pradeep Kumar**, J. Chattopadhyay, B.K. Dutta, On the correlation between minimum thickness and central deflection during small punch test, **Journal of Nuclear Materials** **475 (2016) 37-45**.
2. **Pradeep Kumar**, B.K. Dutta, J. Chattopadhyay and et al., Numerical evaluation of J-R curve using small punch test data, **Theoretical and Applied Fracture Mechanics** **86 (2016) 292-300**.
3. **Pradeep Kumar**, B.K. Dutta, J. Chattopadhyay, Numerical development of a new correlation between biaxial fracture strain and material fracture toughness for small punch test, **Journal of Nuclear Materials** **486 (2017) 332-338**.
4. **Pradeep Kumar**, B.K. Dutta, J. Chattopadhyay, Implementation of theory of plasticity for parametric study on the relation between thickness change and central deflection and fracture point location during small punch test, **Procedia Engineering** **173 (2017) 1101-1107**.

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#### **Latest research work presented in International Conferences**

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1. **Pradeep Kumar**, B.K.Dutta, J.Chattopadhyay, R.S. Shriwastaw, Numerical simulation of SPT data using GTN material damage model to evaluate J-R curve (Paper ID-790), ICCMS-2016, **IIT Bombay, Mumbai**, India June27-July1, 2016.
2. **Pradeep Kumar**, B.K.Dutta, J.Chattopadhyay, R.S. Shriwastaw, Potentiality of Small Punch Test using Damage Model to Generate J-R Curve of 20MnMoNi55 (Paper ID-123), Fatigue Durability India 2016, **IISc Bangalore**, 28-30th September 2016.
3. **Pradeep Kumar**, J. Chattopadhyay, B.K. Dutta, Implementation of theory of plasticity for parametric study on the relation between thickness change and central deflection and fracture point location during small punch test (Paper ID-IMP-382), IMPLAST 2016, **IIT Delhi**, 11-14<sup>th</sup> December 2016.

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## Google scholar profile

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<https://scholar.google.co.in/citations?hl=en&user=z0zIqjsAAAAJ>

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## Strong in basic fundamentals and FEA software

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- ) Mechanics of materials
- ) Mechanics of material fractures (Ductile and brittle)
- ) Fracture mechanics (Elastic and plastic)
- ) Fatigue & damage tolerant analysis (F&DT)
- ) Non-linear material modeling such as rate-dependent and rate-independent like elasto-plastic, Visco-elasticity, creep modeling and etc.
- ) Experienced in Technical Review like research papers and technical reports
- ) Experienced Technical Trainings like theoretical concepts and FEA training using ANSYS and HYPERMESH software
- ) Very good written and oral communication skills
- ) Deep expertise in ANSYS software and linear and non-linear finite element analysis (FEA)