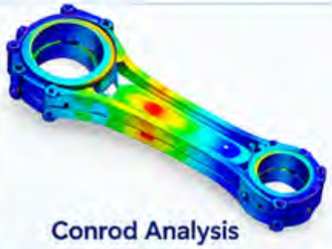
KI TECHNOLOGIES

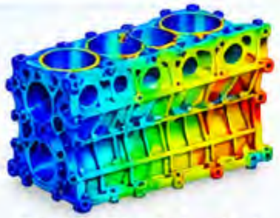
Skill is Everything

ENGINE POWERTRAIN COMPONENT ANALYSIS USING CAE

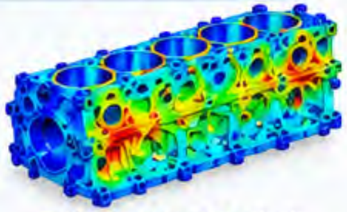
-- Become an Independent FEA/CAE Engineer --



Conrod Analysis



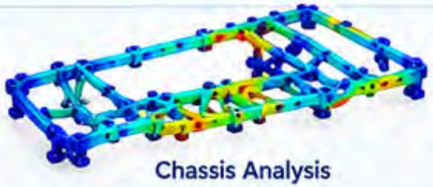
Engine Block Analysis



Cylinder Head Analysis



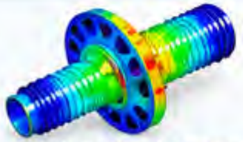
Exhaust Manifold Assembly



Chassis Analysis



Exhaust System Analysis



Bolt Preload Analysis



| FEA Consultant | FEA Trainer | Speaker |

| Creating Highly Skilled Independent CAE/FEA Experts |

50 LECTURE

Practical FEA Theory Knowledge

Learning Through Projects

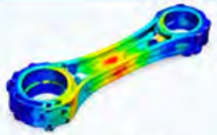
6 Plus Industry Projects

40 Plus Hours Total

Industry Mentorship

Doubt Clear Session

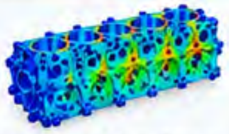
ANALYSIS COVERED IN THIS COURSE



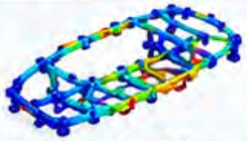
Linear Static Analysis



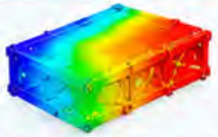
Contact Non-Linear Analysis



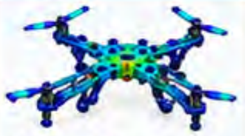
Material Non-Linear Analysis



Linear Buckling Analysis



Thermo-Mechanical Analysis



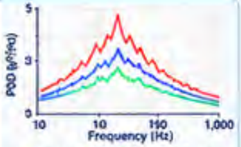
Natural Frequency Response Analysis



Harmonic Analysis



Transient Vibration Analysis



Random Vibration Analysis

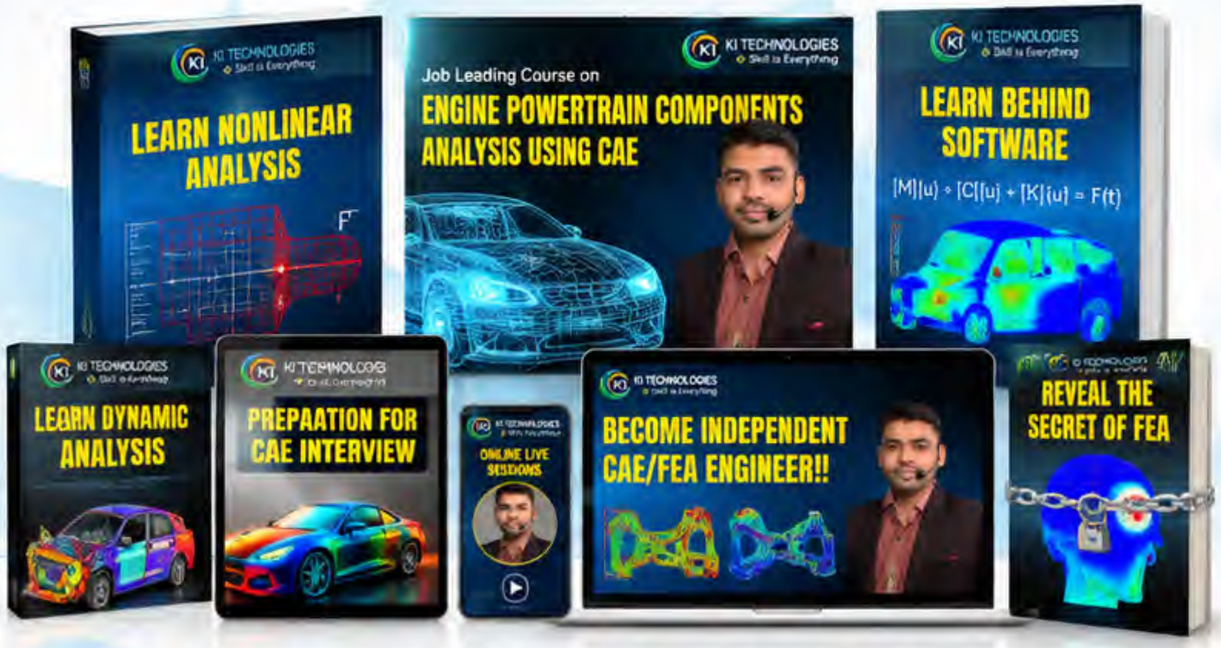
ON-DEMAND VIDEO ACCESS | Learn at your own Pace | Get Personal Mentorship | Project Based Learning | Certification of Completion

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KI TECHNOLOGIES
Skill is Everything

ENGINE POWERTRAIN COMPONENT ANALYSIS USING CAE

-- Become an Independent FEA/CAE Engineer --



Course Objective:

This FEA Deep Learning course offers the best **practical industry** nonies for **thumb rules**, and **guidelines** for the development and validation of finite element models in structural analysis, thermal analysis, linear buckling analysis, thermo-mechanical analysis, Natural frequency response, Harmonic Analysis, and Random vibration analysis.

Helping you to start your career in **CAE Industry**, Helping you to **crack the interview & job opportunities** in CAE and giving you an edge over other engineers, who don't know the industry based Practical FEA projects modeling practices.

This course is designed in such a way as to make you **an independent FEA engineer**. Learn how day-to-day FEA engineers work.

KI Technologies will deliver you real Industry project-based practical knowledge that you need in getting **job in CAE Industry** and help you to solve **assembly-level complex design problems** using Finite Element Analysis.

The objective is to give fresh mechanical engineers or working professionals the keys to **developing industry-required skills** and real knowledge to **work independently** on finite element analysis projects **without facing any problems**.

KI TECHNOLOGIES
Skill is Everything

ENGINE POWERTRAIN COMPONENT ANALYSIS USING CAE

-- Become an Independent FEA/CAE Engineer --



Why You Should Join this Course?

- Start from Zero to the **Professional level.**
- Learn from **CAE Industry Expert.**
- **100% Practical** Project-based Approach.
- Experienced Trainer, **Trained 6000+ Professional** students across the globe.
- **6+ Industry Projects,** Assembly Level Analysis.
- Learn real-life Complex **multi-loading conditions**-based projects.
- Work on **Nonlinear analysis** projects. Learn nonlinear modeling techniques, nonlinear debugging, solver strategies.
- Work on **dynamic analysis** projects and master the art of giving effective design suggestions.



- Learn to **interpret the insights** your FEA software reveals.
- This course will deliver you **real and practical knowledge** that you need for your day-to-day work with FEA.
- Get access to many Practical FEA theory **study materials, files, and support.**
- Learn how to **understand the FEA Project.**
- Learn **"Direct from CAE company".**
- Learn CAE industries **thumb rules.**
- Learn how to **interact with Client** and clear your doubts.
- Learn how to **explain FEA results** to client.

KI TECHNOLOGIES
Skill is Everything

ENGINE POWERTRAIN COMPONENTS ANALYSIS

FEA Deep Learning Technique

Course Syllabus



MR. AJAY SINGH SISODIYA
India Achiever Award (2022)
Entrepreneur of the Year (2023)

50 On Demand Videos

40+ Hours of Content

Learn at Your Own Pace

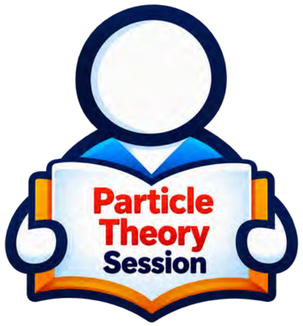


FEA Deep Learning Technique Course Content

01 Linear Static Analysis
02 Contact Non-Linear Analysis
03 Material Non-Linear Analysis
04 Linear Buckling Analysis
05 Thermo-Mechanical Analysis
06 Transient Thermal Analysis
07 Natural Frequency Response Analysis
08 Harmonic Analysis
09 Transient Dynamic Analysis
10 Random Vibration Analysis
11 Basic of Fatigue Analysis

Lecture #1





Introduction to Become FEA Analyst

- **How FEA Engineers Should Think**



How FEA Engineers Should Think

FEA Engineer

Knowledge — Learning

Step-1 : Study or recall your Mechanical Engineering Subject such as Engineering Mechanics , Strength of Material ,TOM, DOM, Dynamic of Machine, Material Science , Thermo Dynamic etc.

Step-2 : Learn FEA Practical theory.

Step-3 : Learn Concept of FEA Modeling technique.

Step-4 : Learn best use of FEA Software and Behind FEA Software.

Step-5 : Learn the art of result interpretation.

Understanding Mechanical System — Think

Step-1.Study the problem.

Step-2. Go out of the comfortable zone.

Step-3. Understand the scope of work, Methodology presentation, define the objective of analysis.

Step-4. Time , Hours , Project Management.

Step-5. Study the CAD file(.igs/.step/x_t).

Step-6. Planning meshing work.

Step-7. Inputs - Material data sourcing.

Step-8. Test report failure data.

Step-9. Deciding boundary conditions.

Step-10. Document your results.

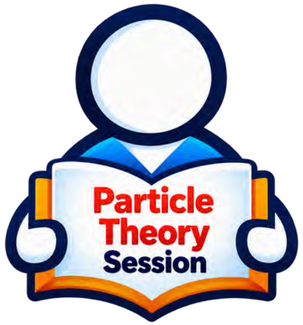
Engineering Judgment — Approach

- Being practical toward FEA results.
- Should adopt a win- win condition.



Lecture #2



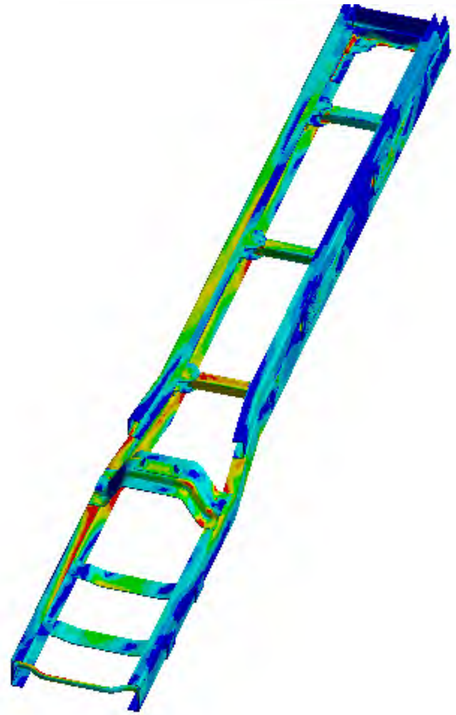


Introduction to Become FEA Analyst

- How to Build the Mindest of FEA Engineer

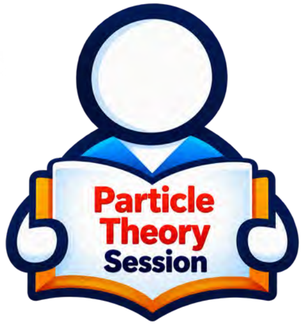
Introduction to Finite Element Analysis (FEA)

- What are the Method of Solving Any Engineering Problem?
- Why Numerical Method is Approximate?
- Introduction to Partial Differential Equation (PDE)
- Process of Finite Element Method Behind the Software
- What is FEA?



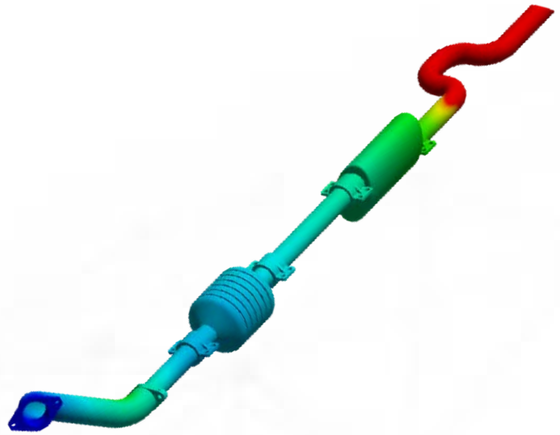
Lecture #3





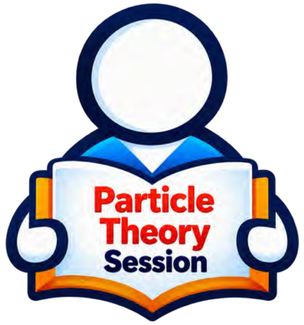
Let's start working with FEA

- Process of Finite Element Method Behind the Software
- What is Shape Functions
- What is Degree of Freedom
- Why 3D Solid Elements Have Three Translation Degrees of Freedom
- Use of FEA in Different Domains
- Process of FEA- How FEA Equation Solved For 1D Problem



Lecture #4



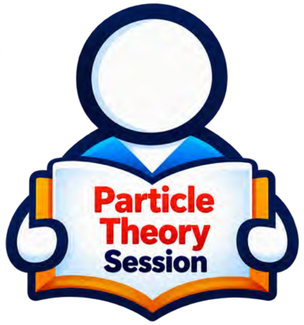


Let's start working with FEA

- What is Process of FEA?
- Need to FEA
- What is Process of FEA?
- How FEA Software Can Help You in Different FEA Domain?
  (A brief discussion about Linear and Nonlinear analysis)
- What is Load and Boundary Conditions
- Material For Different Analysis

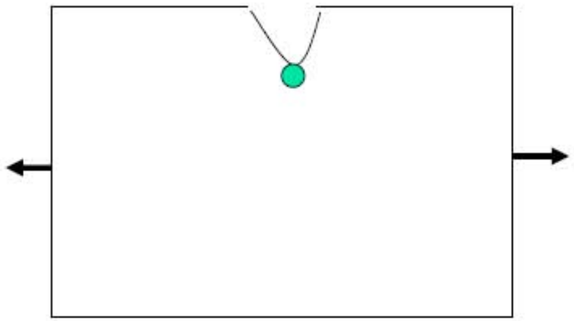
Lecture #5

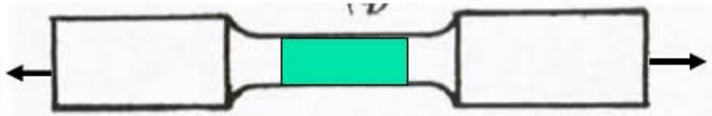




Before You Jump to Software

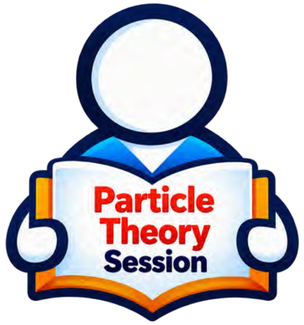
- The Differences Between Isotropic, Anisotropic, Orthotropic, and Laminate Materials.
- How FEA Analysis help you in the Product Development Cycle.
- Past and Future of FEA
- 10 Steps to Follow Before Start Working on FEA Projects
- 12 Common Mistakes by FEA Enginers





Lecture #6





Deep Dive into FEA Basic

- The Equilibrium Equation
- The Heart of FEA - Element Stifness Matrix
- How Global Stiffness Matrix Assembled?
- Linear Static Solvers

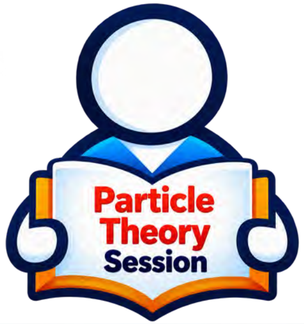
$$k^e = \begin{bmatrix} k_{11} & k_{12} & k_{13} & \cdots & k_{18} \\ k_{21} & k_{22} & k_{23} & \cdots & k_{28} \\ k_{31} & k_{32} & k_{33} & \cdots & k_{38} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ k_{81} & k_{82} & k_{83} & \cdots & k_{88} \end{bmatrix}$$

8×8 matrix (4 nodes × 2 DOF)

$$\overbrace{[M]\{\ddot{u}\}}^{F_{inertia}} + \overbrace{[C]\{\dot{u}\}}^{F_{damping}} + \overbrace{[K]\{u\}}^{F_{Stiffness}} = \overbrace{\{F(t)\}}^{F_{applied}}$$

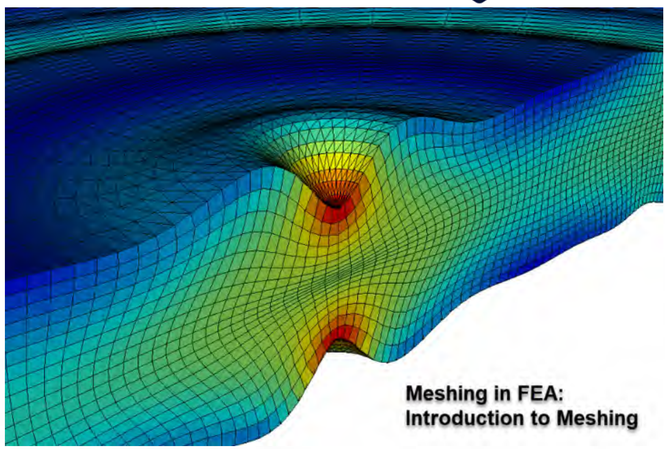
Lecture #7





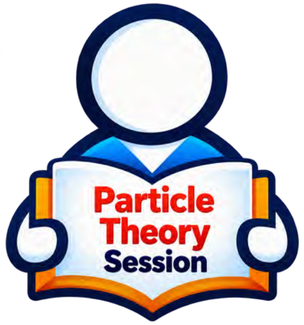
Meshing Techniques

- What is Element Size and How to Decide
- What Do You Mean by Element Type?
- How to Choose the Right Meshing Methodes
- What do You Means by Critical Areas in Meshing
- Why do We Require Mesh Refinement & What Local Sizing
- Linear Elements(1st Order) Vs Quadratic Elements (2nd Order)
- Different Between RBE2 Element and RBE3 Element
- Quality Checks



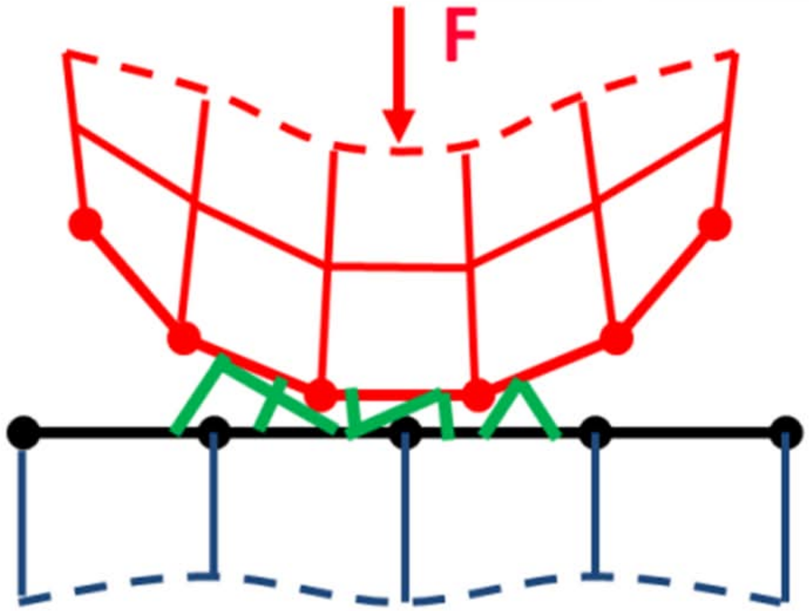
Lecture #8





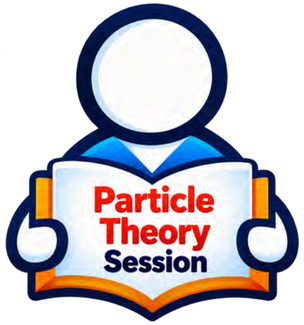
Introduction to the Concept of Contacts

- What is Contact Modeling?
- Contact Methodology & Description of Contact
- Type of Contacts - Linear & Nonlinear
- Selection of Contact Surface (Slave) and Target Surface(Master)
- Thumb Rules





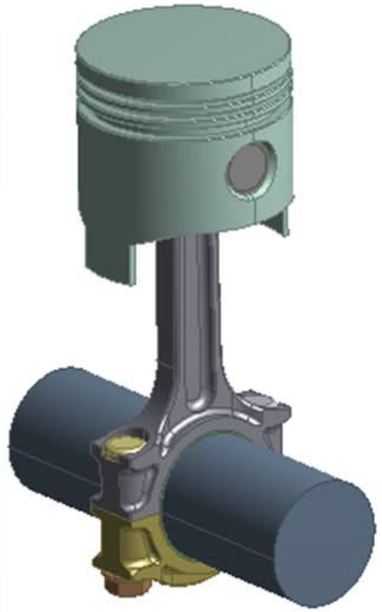
Lecture #9 (Theory Plus Project Work)



Linear Static Analysis

$$[K]\{U\} = \{F\}$$

- What is Linear Static Analysis
- Steps to Solve Linear Static Analysis
- Inputs Require for Linear Static Analysis





51 minutes

Project #1 - Strength Analysis of Con rod

Scope of Work: To carry out the structural analysis of Connecting Rod on existing and proposed materials, Carbon Steel and Proposed material Aluminum Alloys. FEA analysis was carried out by considering two materials of connecting rods for 180cc engine.

Lecture #10 (Project Work-1)

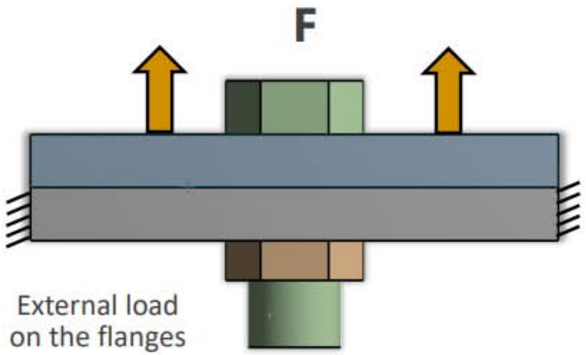
Project #1 - Strength Analysis of Con rod

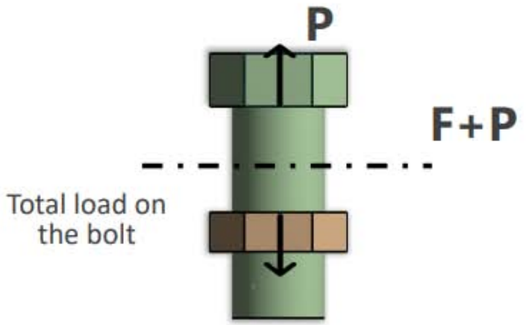
53 minutes

Practical Session

- Geometry Cleanup
- Defining the Parts Names
- Creating New Material, Material Assignment
- Defining Contacts - Linear & Nonlinear







Lecture #11 (Project Work-1)

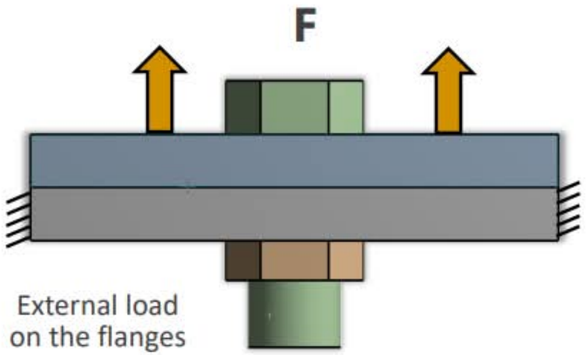
Project #1 - Strength Analysis of Con rod

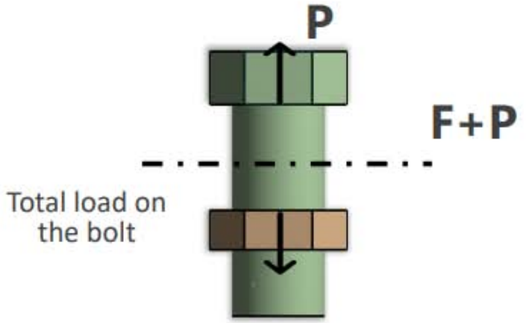
38 minutes

Practical Session

- Defining Meshing Technique
- Setuping Different Load Cases and Solutions
- Understanding Bolt
- Concept of Defining Bolts as 3D, Bolt Pretension
- Defining Load and BC
- Analysis Setting & Run







Lecture #12 (Theory Plus Project Work)



Concepts of Linear Buckling Analysis

- What Do You Mean by Structural Instability
- What is Linear Buckling Analysis
- What is Euler's Formula
- Assumption in Linear Buckling Analysis
- Process of Performing Linear Buckling Anlaysis
- Linear Buckling Analysis Outcome
- What is Critical Load
- What is Buckling Load Factor
- Buckling Analysis Post-Processing





39 minutes

$$F_{buckle} = (F_{applied} \times \lambda)$$

Lecture #13 (Project Work)

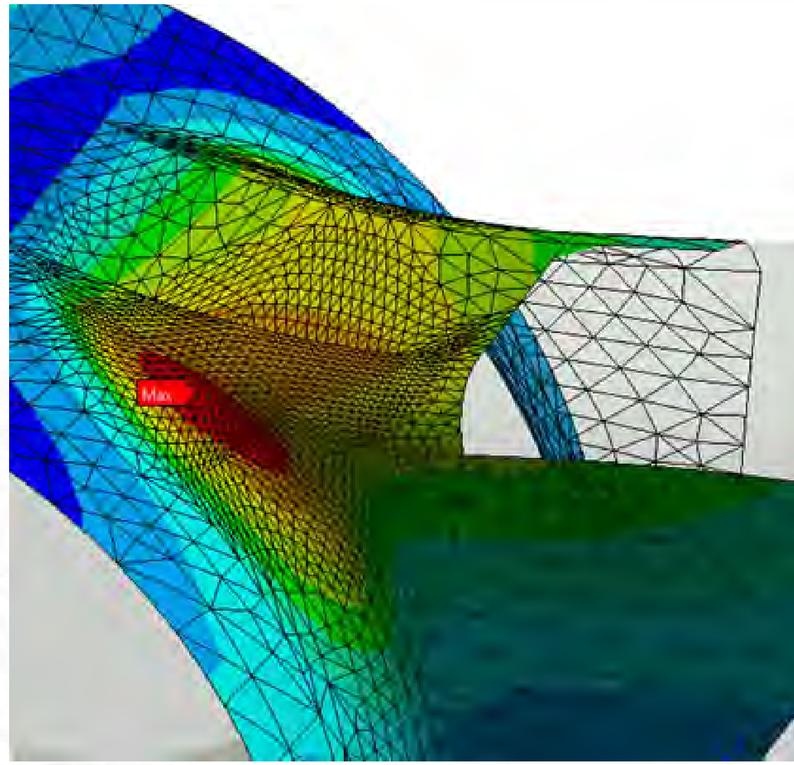




1 Hours 20 Minutes

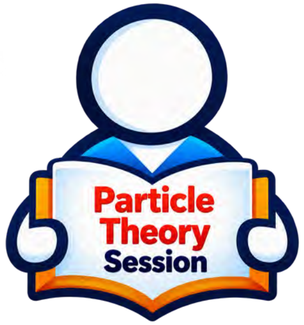
Project #1 - Strength Analysis of Con rod

- Understanding FEA Results & Interpretation
- Post-Processing Techniques
- What is Stress Singularities , How to Ignore that
- How to Make Results PPT For Client



Lecture #14 (Theory Session)

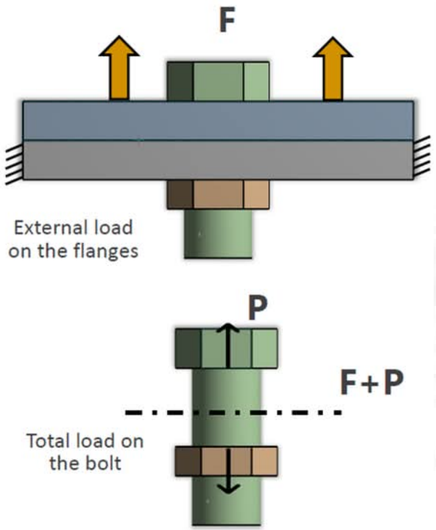


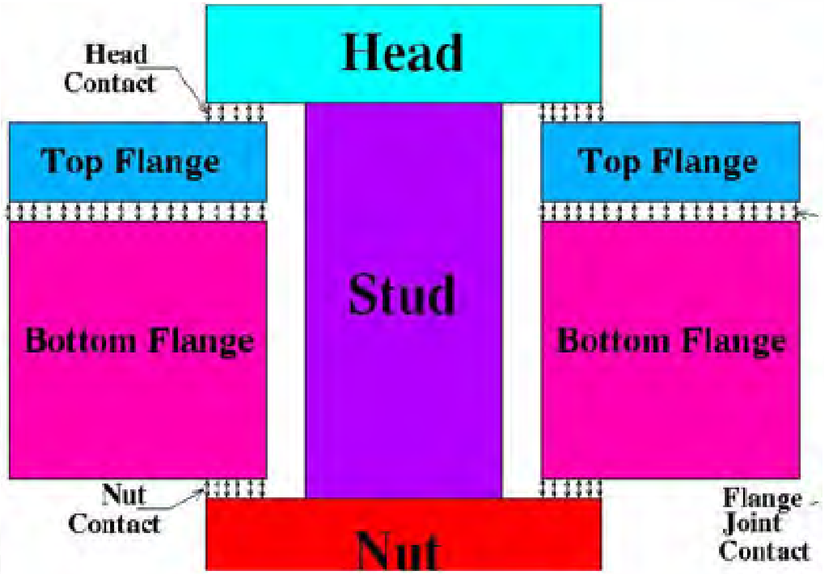


Bolt Modeling

$$P = \frac{1}{\text{FoS}}\left(\sigma_y \times \frac{\pi}{4} D^2\right) - F$$

- Understanding Bolt
- Types of Connection in Bolted Modeling
- Modeling Bolts as 1D & 3D Solid
- Bolt Pretension





Lecture #15 (Theory Session)

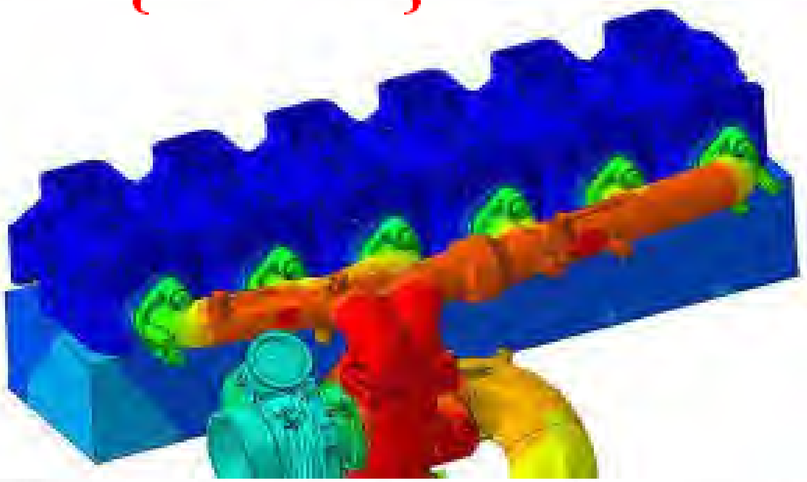
Concept of Thermal Engineering as per FEA Use

Particle Theory Session

35 Minutes

- What is Heat and Mode of Heat Transfers
- Conduction, Convection and Radiation
- Fourier's Law of Equation
- What is Steady State Thermal Analysis
- What is Thermal Conductivity
- Heat Transfer Coefficient (HTC), Heat Flux
- Introduction to Transient Thermal Analysis
- Finally, What is Thermal Analysis Means

$$Q = -KA * \{dT / dX\}$$



Conduction ➤ Convection ➤ Radiation

Lecture #16 (Project Work-2)

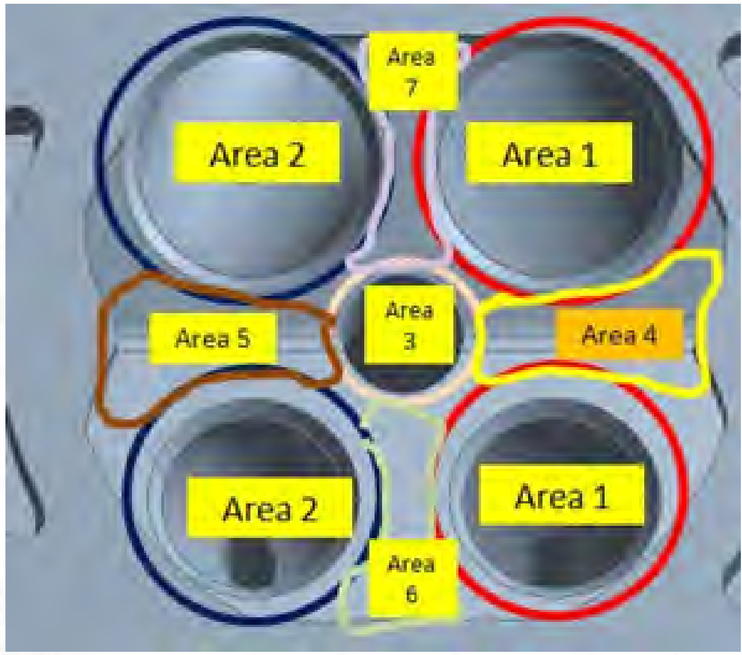
52 Minutes

Practical Session

Thermo-Mechanical Analysis

Project #2 - Thermomechanical Analysis of Cylinder Head Assembly.

Scope of Work: To carry out the thermo mechanical analysis of the Cylinder Head assembly under thermal loading conditions such as Convection (Varying HTC, Temp), on various locations of the head and need to predict temperature distribution on the cylinder head.



FEA analysis was carried out for Peak and Average Pressure conditions under a high-temperature load.

Lecture #17 (Project Work-2)



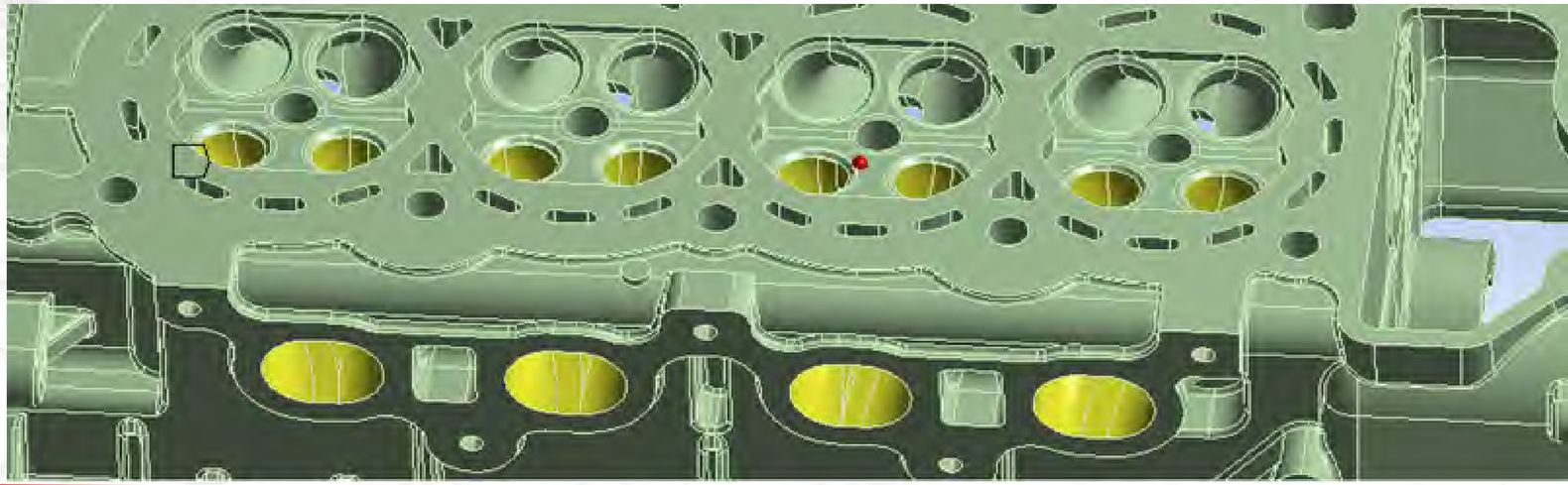
Thermo-Mechanical Analysis

Project #2 - Thermomechanical Analysis of Cylinder Head Assembly.



27 Minutes

Scope of Work: Continue Project Practical Work on Software.



Lecture #18 (Project Work-2 - Results Discussion Session)



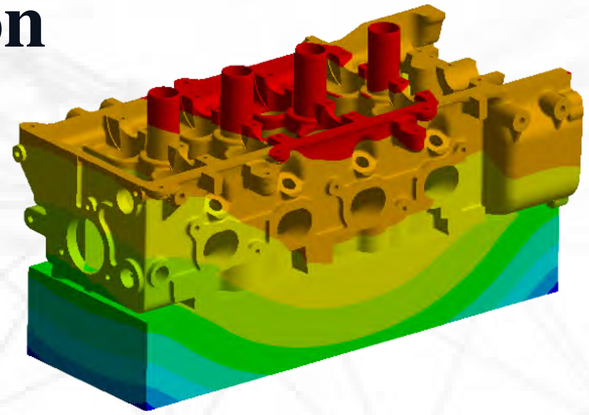
Thermo-Mechanical Analysis

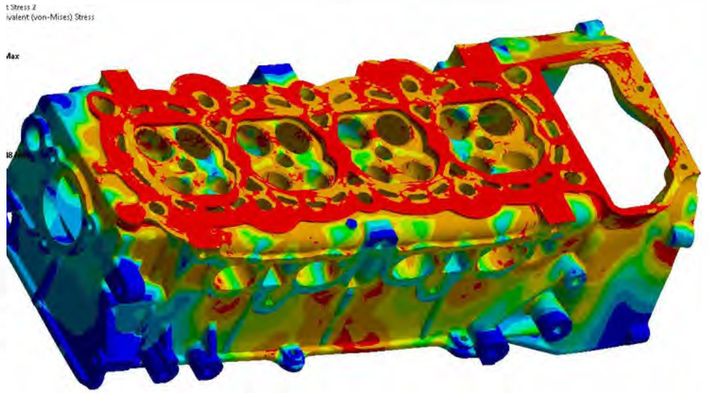
Project #2 - Thermomechanical Analysis of Cylinder Head Assembly.



40 Minutes

- Understanding Thermal Results & Interpretation
- Post-Processing Techniques
- Thermal Stress , Thermal Expansion





Lecture #19 (Theory Session)

Introduction to Nonlinearity

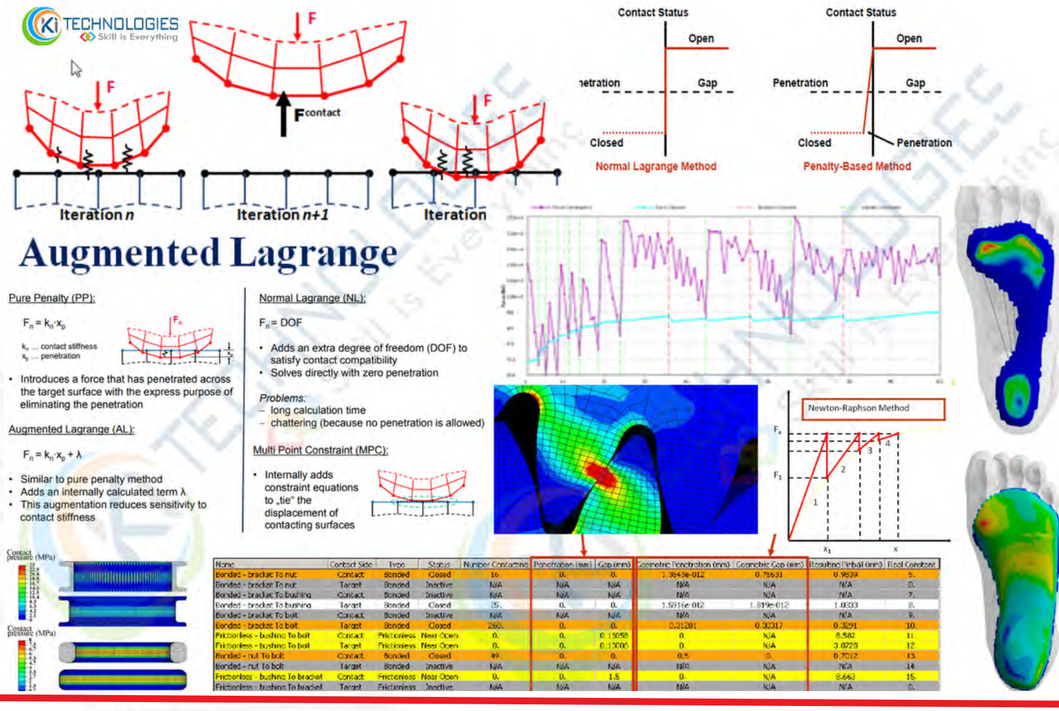
- Linear Vs Nonlinear
- What is Nonlinear System
- Types of Nonlinearity
- Characteristics of Nonlinearity
- Reasons For Nonlinear FEA

Concept of Contact Nonlinearity

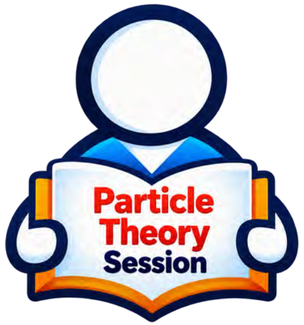
- Contact Nonlinearity
- What is Contact Modelling
- Initial Contact Status

52 Minutes

Particle Theory Session

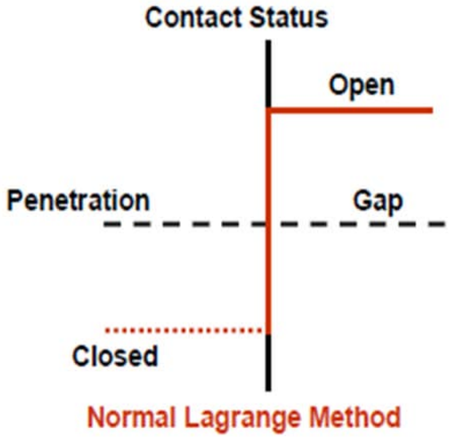


Lecture #20 (Theory Session)

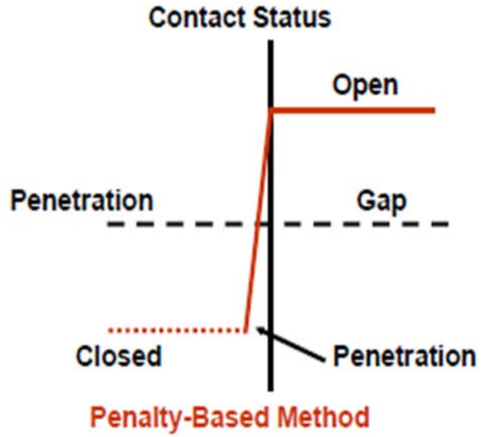


Contact Nonlinearities

- Requirements of Contact Formulations
- Penalty Formulation
- Lagrange Formulation
- Contact Penetration
- Penalty vs Lagrange Formulation
- Stiffness (FKN)
- MPC
- Chattering, Difference in Formulation Techniques
- Penetration Tolerance (TOLN)
- Small Sliding vs Large Sliding Assumption
- Symmetric Behaviour
- Pinball Region, Interface Treatment: Adjust to touch

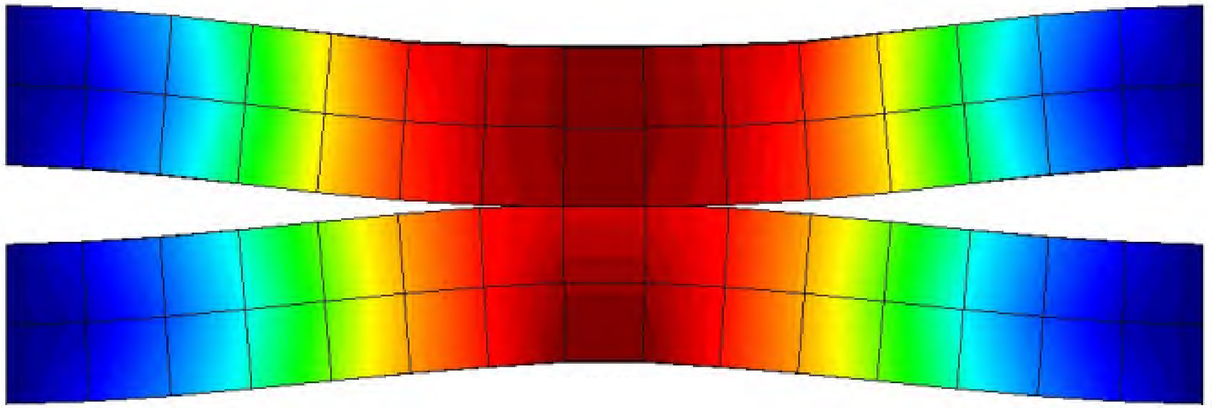


Normal Lagrange Method



Penalty-Based Method


45 Minutes

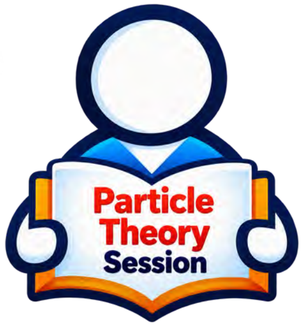


Lecture #21 (Theory Session)

Solving Nonlinear Problems -Behind FEA Software



46 Minutes

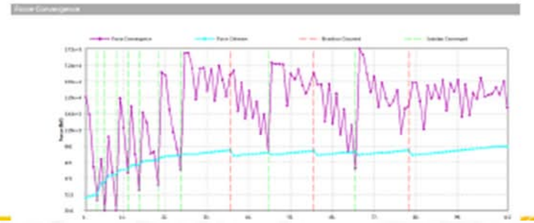


- Contact formulation - Stabilizations
- Contact results
- Newton Raphson Method
- Force Convergence Plots
- Force Convergence – Bisection
- Convergence Problems
- How to deal with convergence issues
- Convergence issue - Error
- Understanding the Solver Output
- Debug strategies

- First step is to determine the cause:
  1. Rigid body motion
  2. Force balance not obtained
  3. Material Instabilities
  4. Element formulation error
  5. Combination of items 1-4 above



- We will examine each in detail including:
  - identifying the problem
  - determining the cause
  - providing solutions





Lecture #22 (Project Work-3)

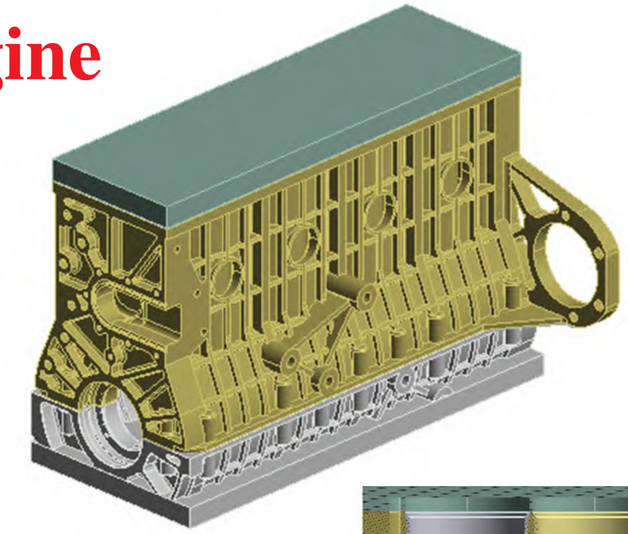
Steady State Thermal And Transient Thermal Analysis



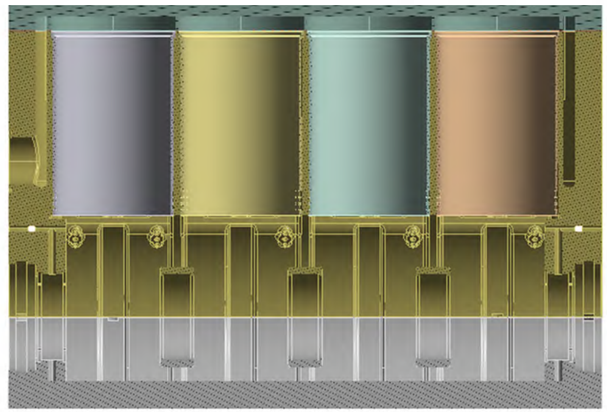


52 Minutes

Project #3- Thermomechanical Analysis of Engine Block Assembly.



Scope of Work: To carry out the thermo mechanical analysis of the Engine block under thermal loading conditions such as cylinder temperature, and convection on various locations of the engine block and need to predict temperature distribution on the Engine Block Assembly.



FEA analysis was carried out for cylinder pressure and main bearing Pressure conditions under a high-temperature load.

Lecture #23 (Project Work-3)

Steady State Thermal And Transient Thermal Analysis

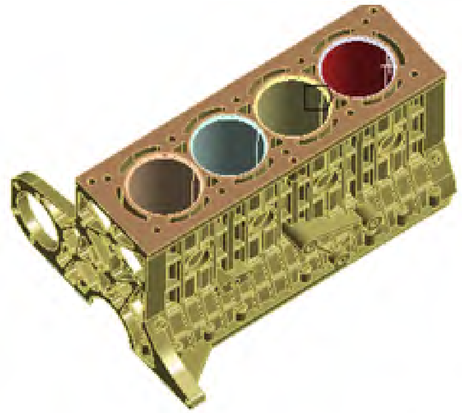


Project #3- Thermomechanical Analysis of Engine Block Assembly. Continue Project work for Transient Analysis.



30 Minutes

Scope of Work: To carry out the transient mechanical analysis of the Engine block under thermal loading conditions such as cylinder temperature with respect to time, and convection on various locations of the engine block and need to predict temperature distribution on the Engine Block Assembly.



FEA analysis was carried out for cylinder pressure and main bearing Pressure conditions under a high-temperature load.



	Steps	Time [s]	Temperature [°C]
1	1	0.	22.
2	1	0.1	0.
3	1	0.2	0.
4	1	0.3	0.
5	1	0.4	0.
6	1	0.5	0.
7	1	0.6	220.
8	1	0.7	0.
9	1	0.8	0.
10	1	0.9	0.
11	1	1.	0.

Lecture #24 (Project Work-3 - Results Discussion Session)



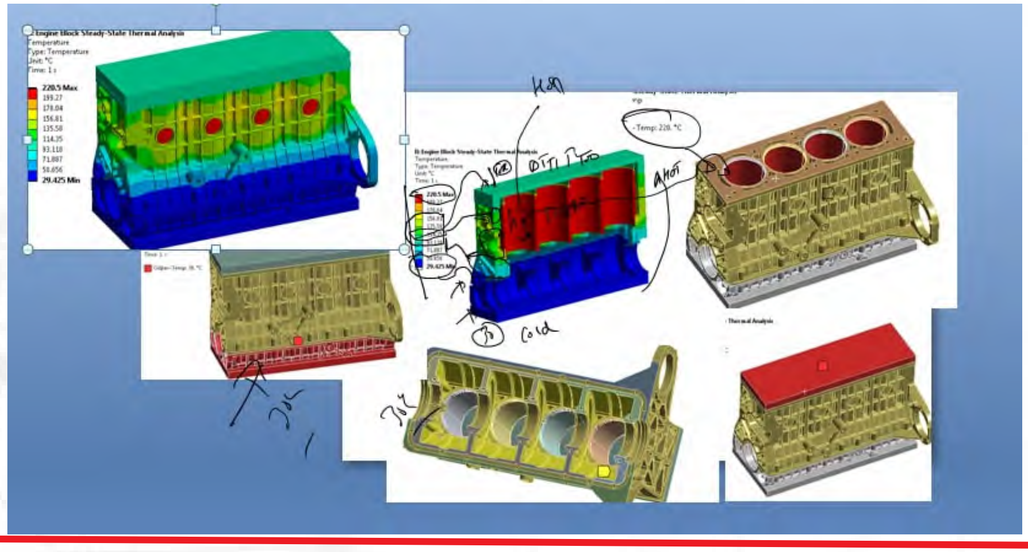
Thermo-Mechanical Analysis

Project #3 - Thermomechanical Analysis of Engine Block Assembly.



47 Minutes

- Understanding Thermal Results & Interpretation
- Post-Processing Techniques
- Thermal Stress , Thermal Expansion

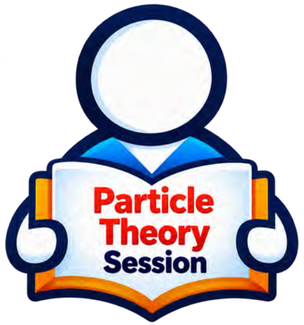


Lecture #25 (Theory Session)

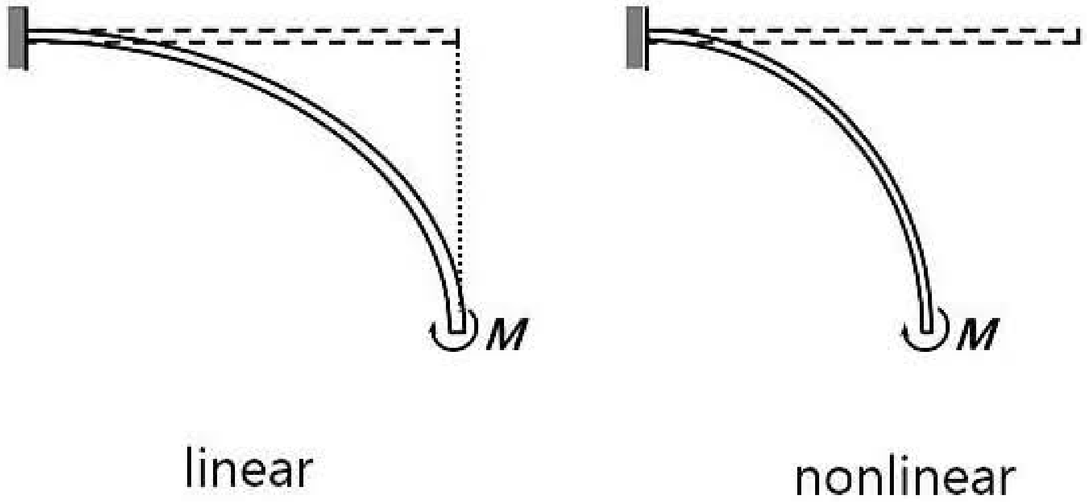
Geometric Nonlinearity



30 Minutes



- What is Geometric Nonlinearity
- Sources of Geometrical Nonlinearity
- Large Strain, Large Rotation, Stress Stiffening, Large Rotations
- Guidelines for Geometric Nonlinearity
- Application of Geometric Nonlinearity



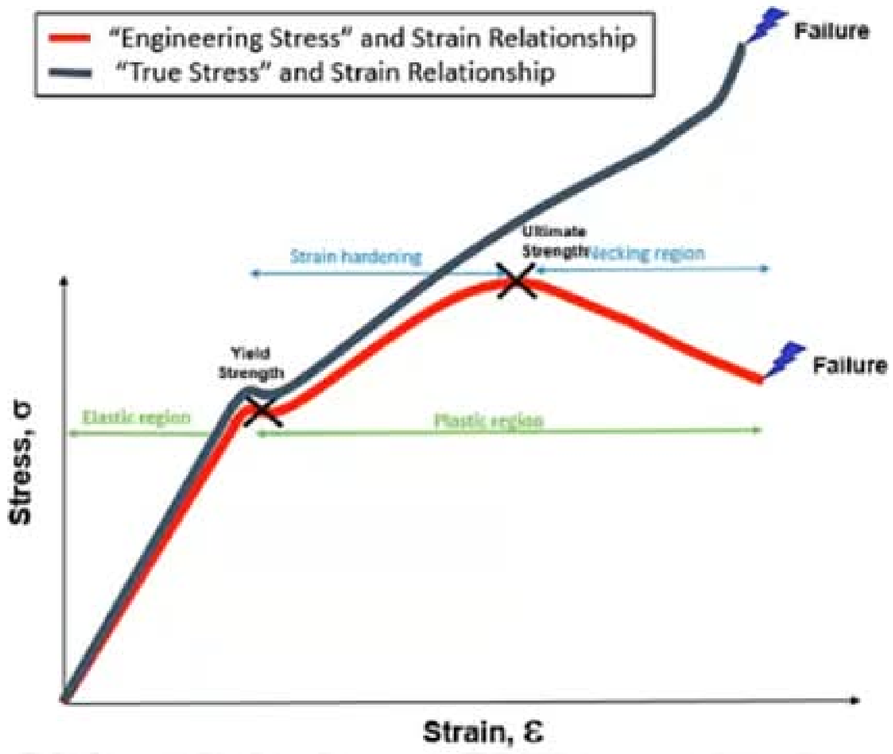
Lecture #26 (Theory Session)

Concept of Material Nonlinearity

37 Minutes

Particle Theory Session

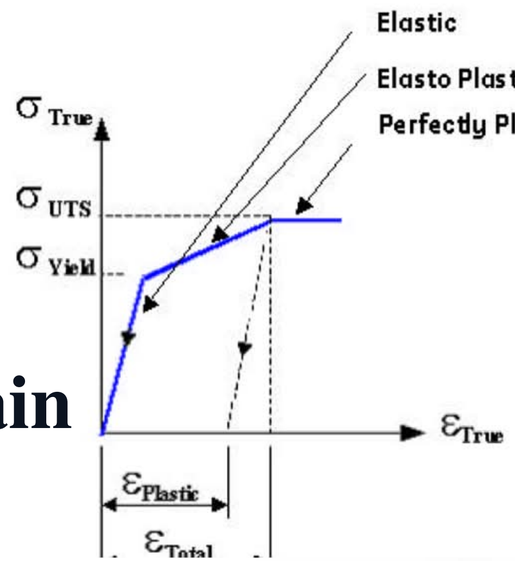
- Basic of Material Science
- Engineering Stress Strain Diagram
- Engineering Stress Strain Diagram For Brittle Material
- Relationship between Engineering Stress & True Stress and Engineering Strain & True Strain

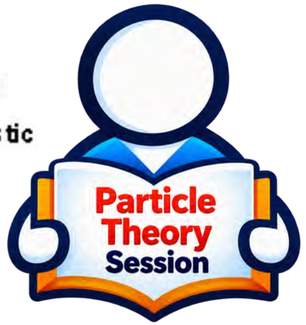


Lecture #27 (Theory Session)

Deep into Material Nonlinearity

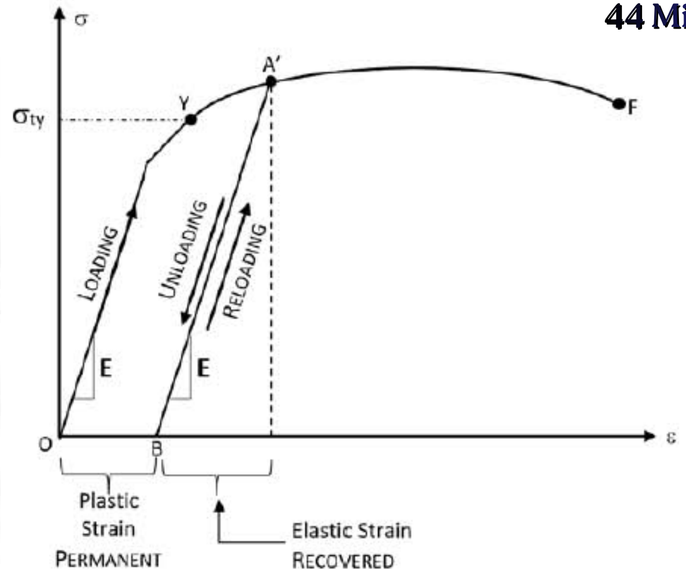
- Mechanism of Plasticity
- Mechanism of Plasticity - Elastic and Plastic Strain
- Elasto-Plastic Material Curve
- Perfectly Plastic Curve
- Multi-linear Hardening Curve
- Strain Hardening - Hardening Rules
- Do I Really Need a Material Nonlinear Analysis







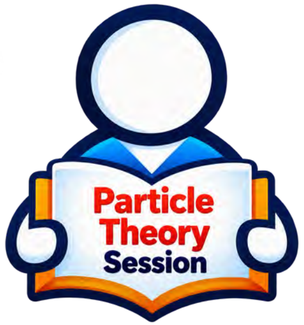
44 Minutes



Lecture #28 (Theory Session)



32 Minutes



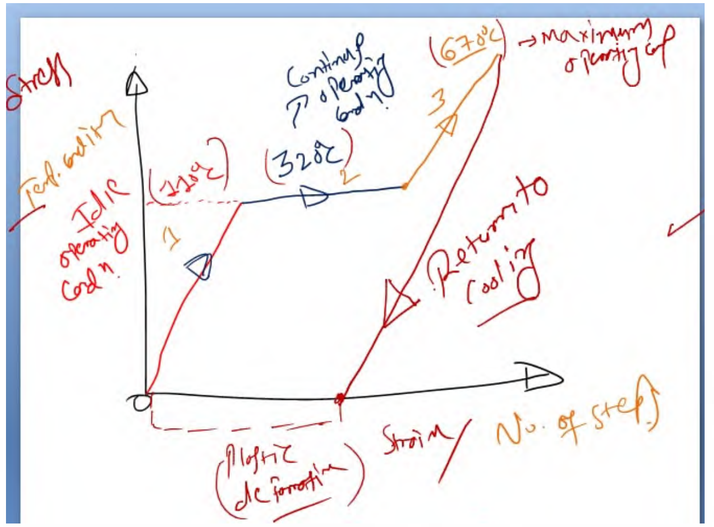
Deep into Material Nonlinearity

- Isotropic and Kinematic Hardening
- Introduction to Hyperelasticity
- Why Use Hyperelastic Models?
- Hyper Plastic Material Model – Energy Functional
- Neo-Hookean Model, Mooney-Rivlin Model, Ogden Model, Ogden Foam Model
- Introduction to Creep
- What is Creep ?, Creep Testing
- Creep Curve, Creep Failure.

Lecture #29 (Project Work-4)

Thermo-Mechanical Analysis - Cyclic Loading Strain Harding

Project #4 -Thermomechanical Analysis of Exhaust Manifold Assembly.



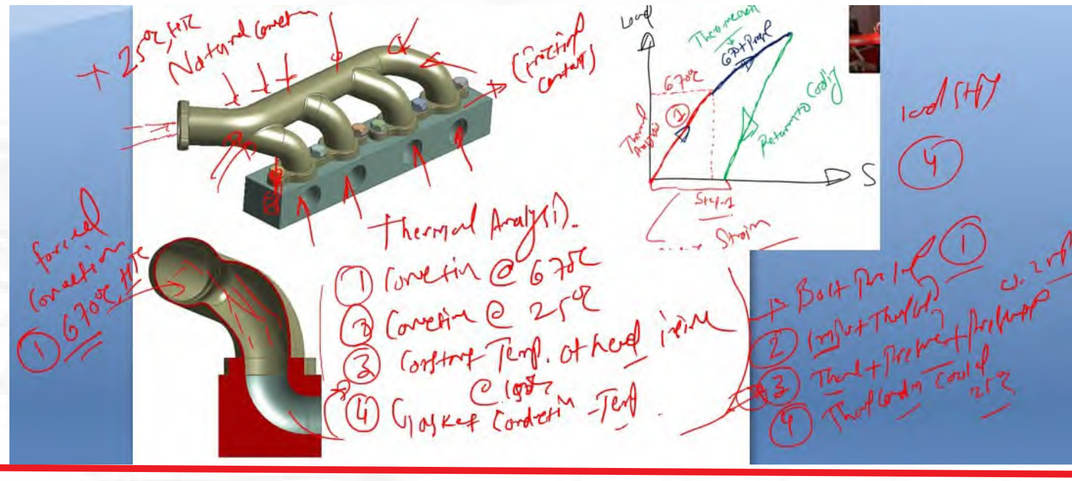




50 Minutes

Scope of Work: The Objective of our analysis is to validate the exhaust manifold design and to find out the thermal stresses and deformations due to high temperature on the exhaust manifolds of off-road vehicle diesel engines.

FEA analysis was carried out for cyclic loading, nonlinear contact, multilinear material and Maximum Pressure conditions under a high-temperature load.



Lecture #30 (Project Work-4-Setup)



30 Minutes



Thermo-Mechanical Analysis - Cyclic Loading Strain Harding

Project #4 -Thermomechanical Analysis of Exhaust Manifold Assembly.

- Set-up Loads and Boundary Conditions
- Thermal Analysis- Loads
- Multi-Linear-Hardening Material Setup
- Thermo-Mechanical Analysis

Lecture #31 (Project Work-4-Results Discussion Session)



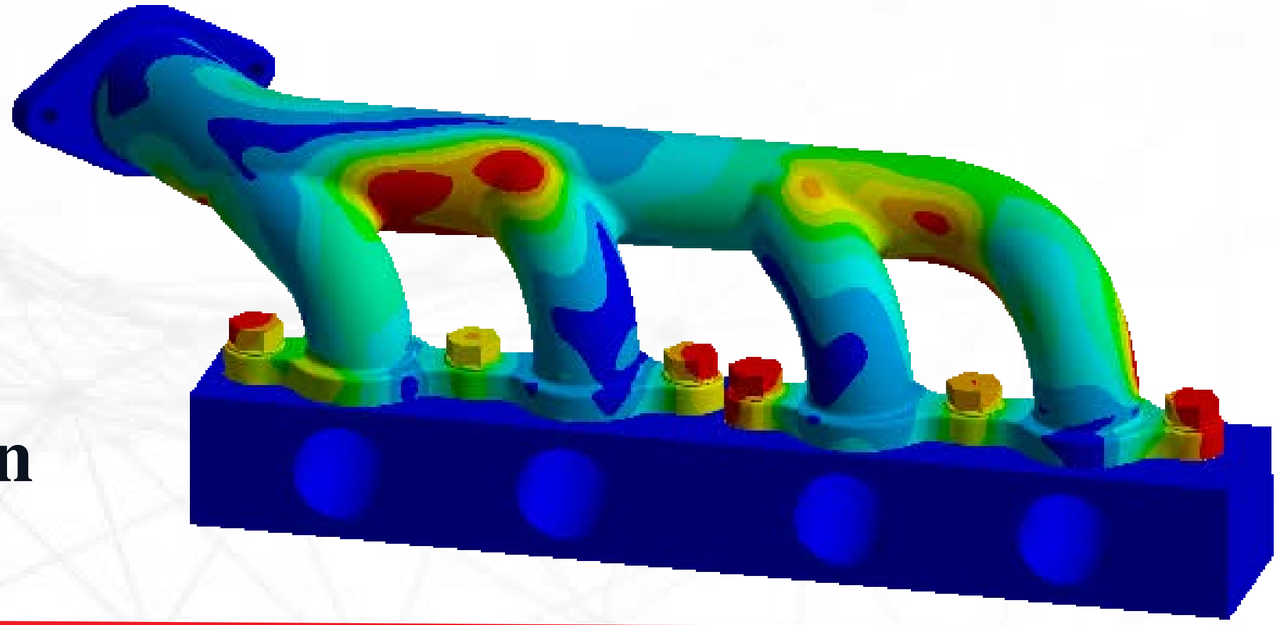


38 Minutes

Thermo-Mechanical Analysis - Cyclic Loading Strain Harding

Project #4 -Thermomechanical Analysis of Exhaust Manifold Assembly.

- Understanding Thermal Results & Interpretation
- Post-Processing Techniques
- Thermal Stress , Thermal Expansion
- Elastic and Plastic Strain



Lecture #32 (Practical Theory Session)

Let's get into Vibration - Dynamic Analysis

Natural Frequency Response Analysis.



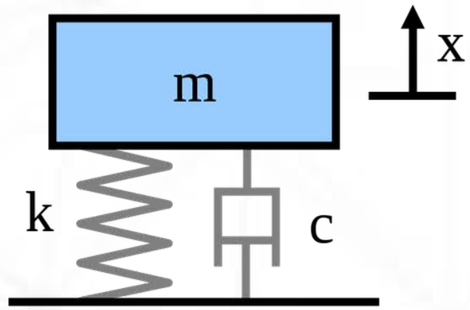


- Types of Dynamic Analysis
- The Equation of Motion
- What is Frequency
- What is Natural Frequency Analysis
- What do You Mean by Modes
- How Many Natural Frequencies any Object Can Have?
- Why to Evaluate Natural Frequency?
- The Eigen Equation
- What is Pre-Stress Modal Analysis
- Why to Analysis Modal Analysis
- How to Avoid Resonance
- How Natural Frequency and Mode Shape Influenced Desing



$$([K] - \omega_i^2[M])\{\phi\}_i = \{0\}$$

$$([K + S] - \omega_i^2[M])\{\phi\}_i = \{0\}$$



Lecture #33 (Project Work-5)

Dynamic Analysis of Motor Mounting Frame

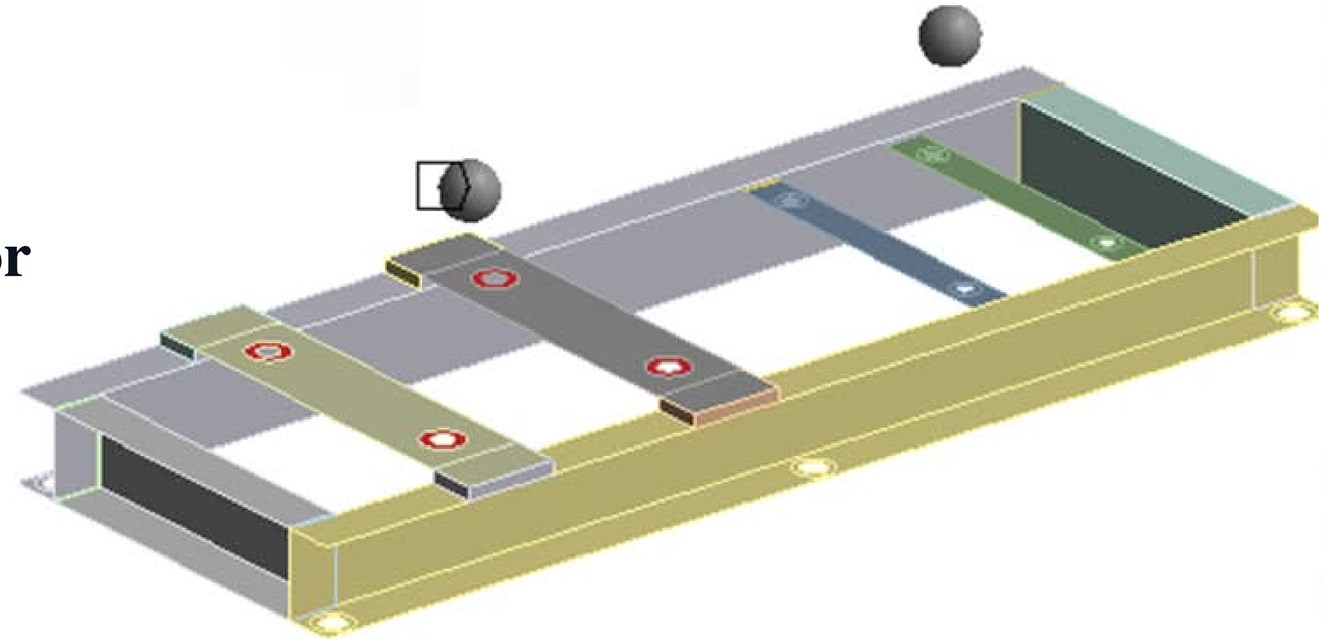
26 Minutes

Practical Session

Project #5-Dynamic Analysis of Motor Mounting Frame.

Scope of Work: The objective of the Modal analysis of the frame is to validate the design of the frame and avoid resonance under motor mass & rotor mass loading conditions.

We need two find the natural frequency and mode shape of the frame.



Lecture #34 (Project Work-5-Results Discussion Session)

Dynamic Analysis of Motor Mounting Frame

Computing Modal Analysis Analysis.

Project #5-Dynamic Analysis of Motor Mounting Frame.





36 Minutes

- Understanding Modal Analysis Results & Interpretation
- Post-Processing Techniques of Modal Analysis
- How do you determine the no of modes (6,10,15,20 …1000) extracted is sufficient or not?.
- How to find the critical natural frequencies or modes?
- Wn, Mode Shape, Frequency, Effective Mass
- What is Effective Mass and Mass Participation Factor
- Resonance Modification and Suggestion

***** PARTICIPATION FACTOR CALCULATION ***** X DIRECTION

MODE	FREQUENCY	PERIOD	PARTIC.FACTOR	RATIO	EFFECTIVE MASS	CUMULATIVE MASS FRACTION	RATIO EFF.MASS TO TOTAL MASS
1	41.5740	0.24054E-01	0.19660E-03	0.000266	0.386526E-07	0.618890E-07	0.606698E-07
2	59.3475	0.16850E-01	0.73795	1.000000	0.544569	0.871941	0.854765
3	66.9127	0.14945E-01	0.27457	0.372071	0.753884E-01	0.992650	0.118331
4	81.8562	0.12217E-01	-0.12516E-02	0.001696	0.156654E-05	0.992653	0.245888E-05
5	92.9137	0.10763E-01	0.70548E-05	0.000010	0.497705E-10	0.992653	0.781206E-10
6	108.370	0.92277E-02	-0.26972E-03	0.000366	0.727507E-07	0.992653	0.114191E-06
7	513.886	0.19460E-02	0.31058E-01	0.042087	0.964600E-03	0.994197	0.151405E-02
8	692.268	0.14445E-02	-0.75293E-03	0.001020	0.566899E-06	0.994198	0.889815E-06
9	693.572	0.14418E-02	-0.16281E-01	0.022062	0.265056E-03	0.994623	0.416037E-03
10	736.286	0.13582E-02	0.14139E-03	0.000192	0.199917E-07	0.994623	0.313793E-07
11	770.306	0.12982E-02	-0.21390E-01	0.028986	0.457529E-03	0.995355	0.718146E-03
12	824.060	0.12135E-02	0.53859E-01	0.072985	0.290079E-02	1.00000	0.455313E-02
sum					0.624547		0.980301

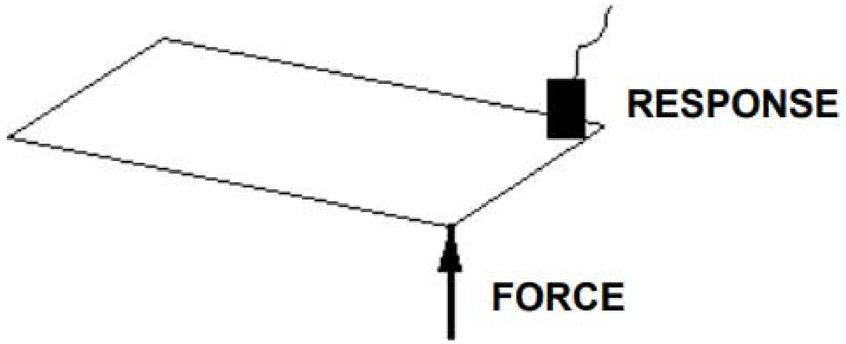
Lecture #35 (Practical Theory Session)

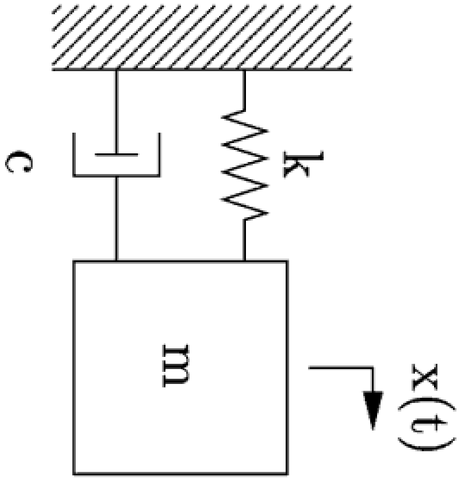




Harmonic Analysis - Force Frequency Response

- Introduction to Damping
- What are Spring, Mass, and Damper's representations in mechanical engineering?
- Now, When to consider damping?
- Introduction - Why Harmonic Analysis ?
- Harmonic Analysis - Assumptions and Restrictions
- Difference Between Time Domain and Frequency Domain in the field of dynamics.
- What are the differences between the Mode-Superposition Method and the Full Method Harmonic Analysis?.





Lecture #36 (Project Work-6)



Dynamic Analysis of Exhaust System



30 Minutes

Project #6 - Dynamic Strength Analysis of Exhaust System.

Scope of Work:

1. To determine the Natural Frequency of the Exhaust System by Modal Analysis (10 modes)
Completely Free – Free Free run
Partially Constrained -Fixed at Manifold-outer Surface
Completely Constrained - Fixed at Manifold-outer Surface and All Hanger points.

2. Linear Static Analysis to calculate stress distribution & maximum displacement due to self-weight & External loading conditions. Gravity + Mounting reaction force.

3. Performing Harmonic analysis of the system using Linear Static Analysis as Prestress

Lecture #37 (Project Work-6)

Dynamic Analysis of Exhaust System





8 Minutes

Project #6- Dynamic Strength Analysis of Exhaust System.

Scope of Work: Continue Practical work on Software

- Analysis setup - Self weight , Static Analysis
- Free , Free Modal Analysis
- Fixed based modal analysis
- Harmonic Analysis



Lecture #38 (Project Work-6-Results Discussion Session)



Dynamic Analysis of Exhaust System



35 Minutes

Project #6- Dynamic Strength Analysis of Exhaust System.

- Understanding Free Free Modal Analysis, Partially Fixed, Fully Fixed, Gravity Load Results, and Harmonic Analysis Results & Interpretation
- Post-Processing Techniques Combined Analysis



Lecture #39 (Project Work-7)



Tata 8x8 Truck Chassis Frame Structural and Dynamic Analysis

Project #7 - Dynamic Strength Analysis of Truck Chassis



44 Minutes

Scope of Work: FEA to investigate the Truck chassis response under static loads as well as the natural frequencies and ultimately the harmonic response under dynamic loads due to road excitations.

The simulation results could verify the feasibility of the choice, which could reduce the weight of the chassis with no infection of its performance and provide a reference for automobile lightweight simulation studies.

Lecture #40 (Project Work-7)



Strength & Dynamic Analysis of Automobile Chassis

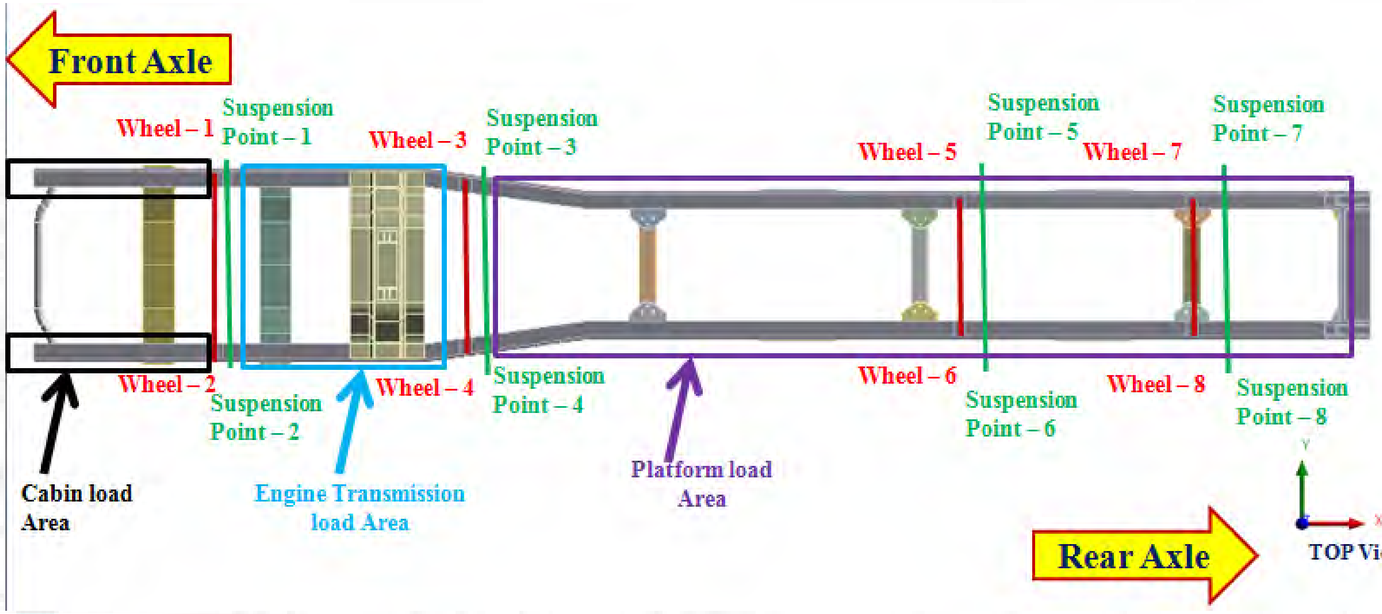


51 Minutes

Project #7 - Dynamic Strength Analysis of Truck Chassis

Scope of Work: Continue Practical work on Software

- Bending Load Case Analysis
- Lateral Load Case Analysis
- Torsion Load Case Analysis
- Combined Load Case Analysis
- Dynamic Load Case Analysis



Lecture #41 (Project Work-7-Results Discussion Session)



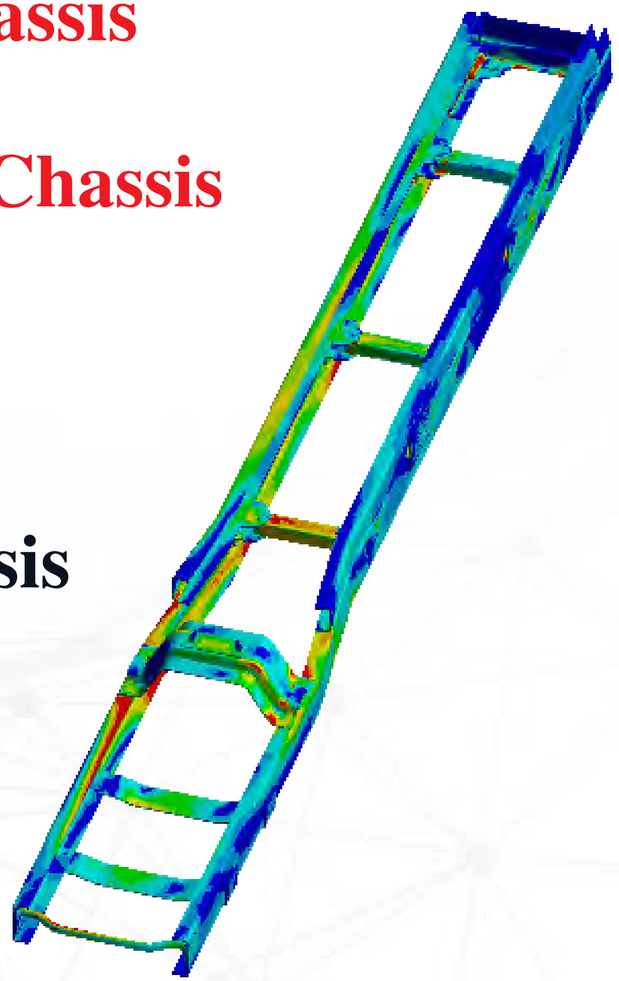


34 Minutes

Strength & Dynamic Analysis of Automobile Chassis

Project #7 - Dynamic Strength Analysis of Truck Chassis

- Understanding Strength & Dynamic Analysis Results & Interpretation
- Post-Processing Techniques Combined Analysis



Lecture #42 (Theory Session)

Transient Dynamic Analysis Concepts



35 Minutes



- What is Transient Analysis?
- Static Analysis Vs Transient Analysis
- Methods of Transient Dynamic Analysis
- Concepts of Linear and Nonlinear Transient Dynamic Analysis.
- Importance of Numerical Accuracy in Transient Response
- Extraction of Sufficient Number of Modes
- Damping Types in Transient Analysis
- Types of Transient Loads
- Time Step Settings

Lecture #43 (Project Work-8)





18 Minutes

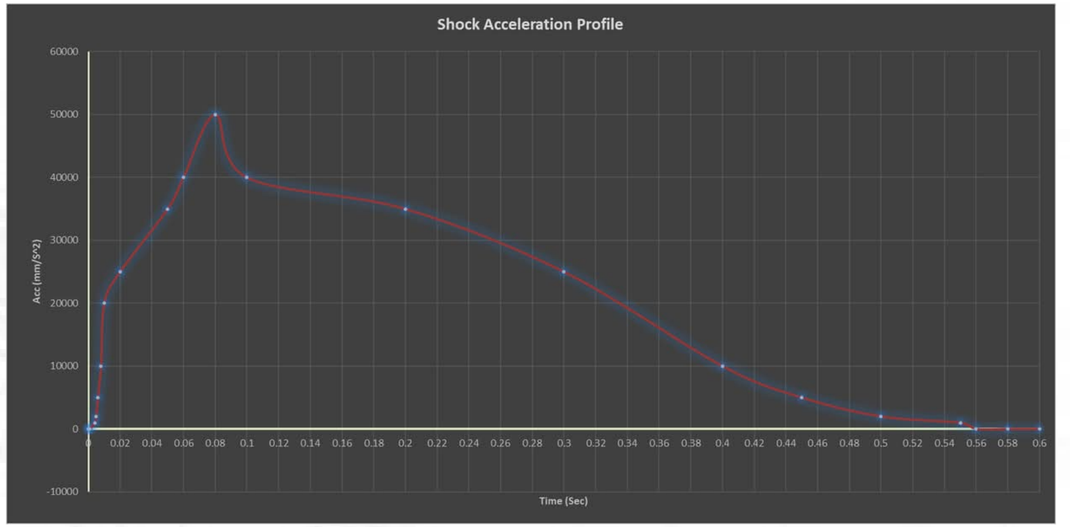
Transient Dynamic Analysis of Mounting Frame



Project #8 - Shock Analysis of a Motor Pump Mounting Frame

Scope of Work: The objective of this simulation is to perform a dynamic shock analysis (transient dynamic analysis) of a motor pump mounting frame subjected to a given shock loading profile

- Modal analysis results review
- Shock profile load setup
- Time step setup -Analysis Setting
- Results Discussion - Postprocessing



Lecture #44 (Practical Theory Session)



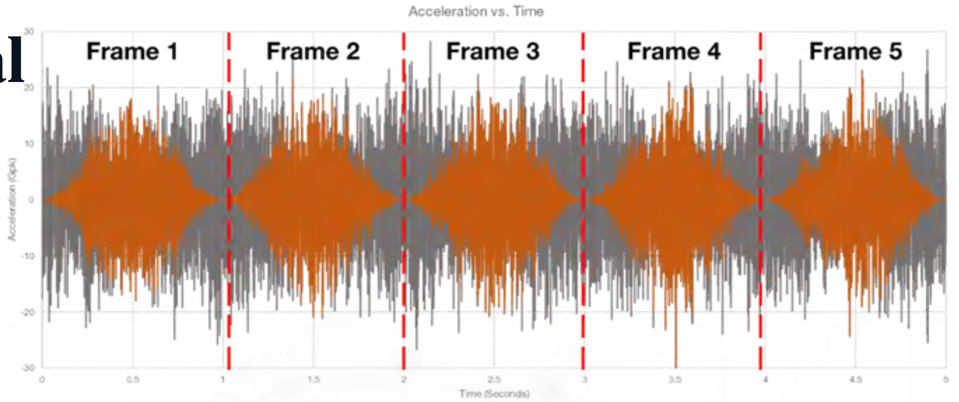
30 Minutes



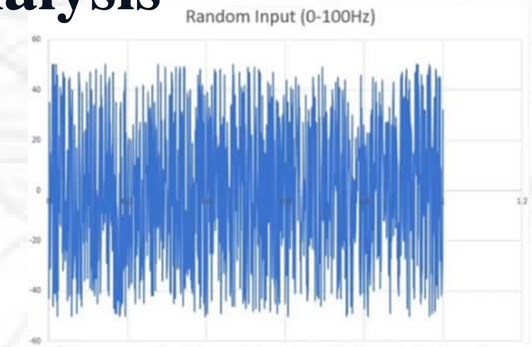


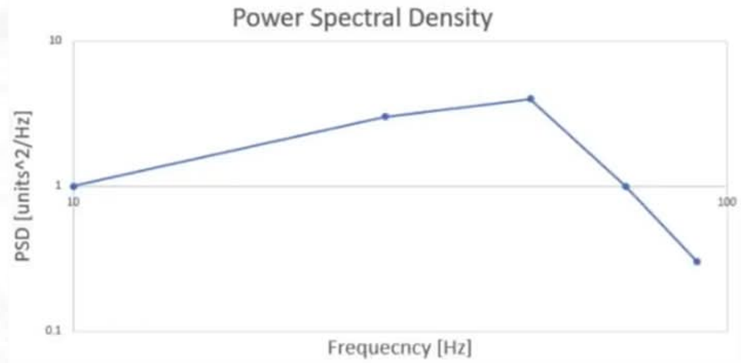
Random Vibration Analysis Concepts

- How Mechanical Vibration System Work
- Types of Excitation, Periodic , Impulse and Sinusoidal
- Why Random in Nature
- What is Random Vibration Analysis
- What is PSD
- Types of Load in Random Vibration Analysis









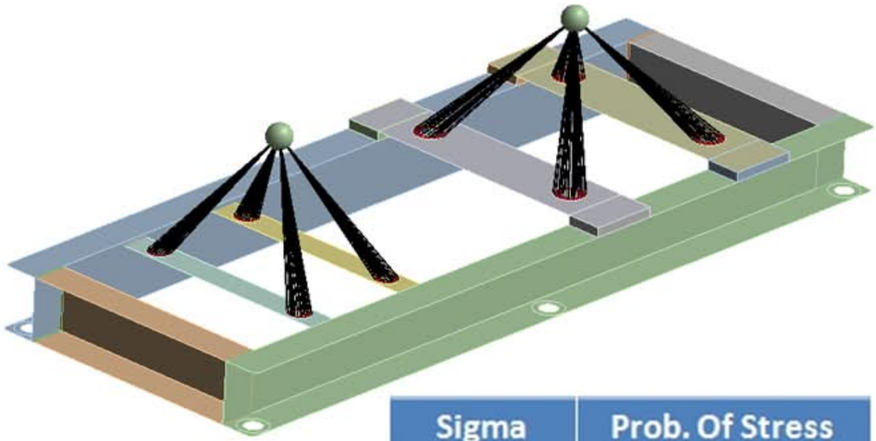
Lecture #45 (Project Work-9)

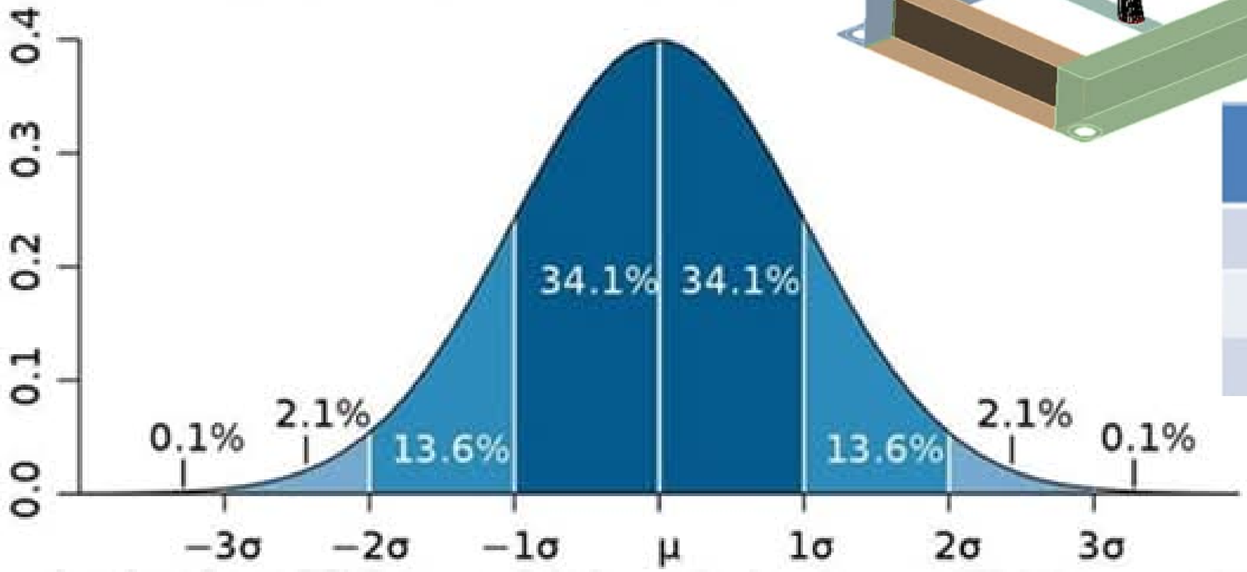
Project #9 - Random Vibration Analysis of Mounting Frame



24 Minutes

- Random Vibration Analysis Results Interpretation
- What is One Sigma Stress , 1 Standard deviation value, 2 Sigma and 3 Sigma
- Gaussian distribution.
- Post-processing Techniques





Sigma	Prob. Of Stress Within Stress
1	68.3%
2	95.4%
3	99.3%

Lecture #46 (Project Work-10)





20 Minutes

Self-Changing Project Work

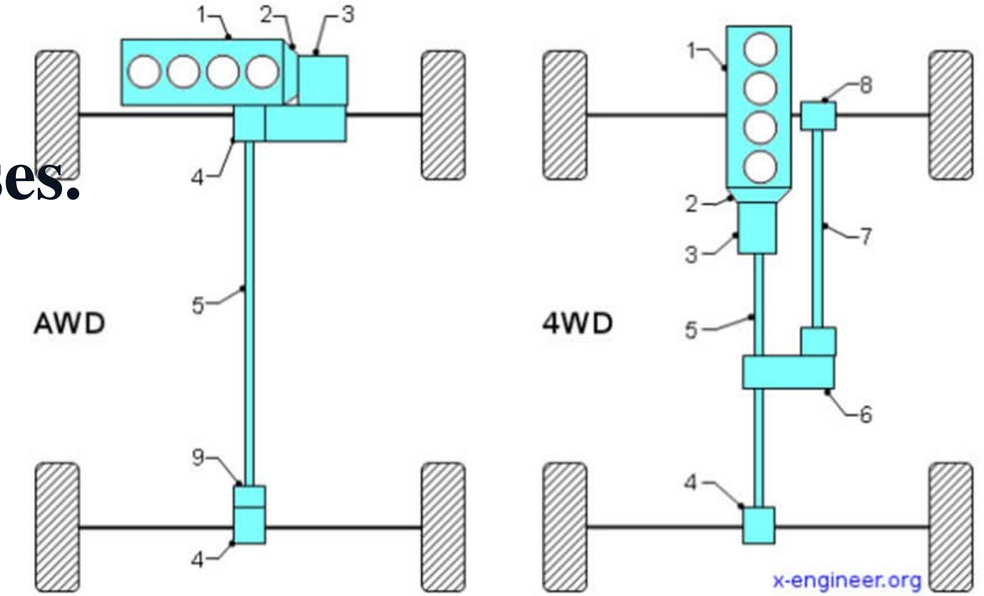
change

Project #10 - Strength Analysis of Transfer Case Housing

Scope of Work: To evaluate the strength and durability performance of Transfer Case Housing.

Housing evaluation was done under three load cases.

1. **Bolt Preloads.**
2. **Chain Load – For Spike Torque.**
3. **Chain Load – For Skid Torque.**
4. **Front Imbalance load Case**
5. **Rear Imbalance load Case**



Lecture #47 (Project Work-10-Results Discussion Session)

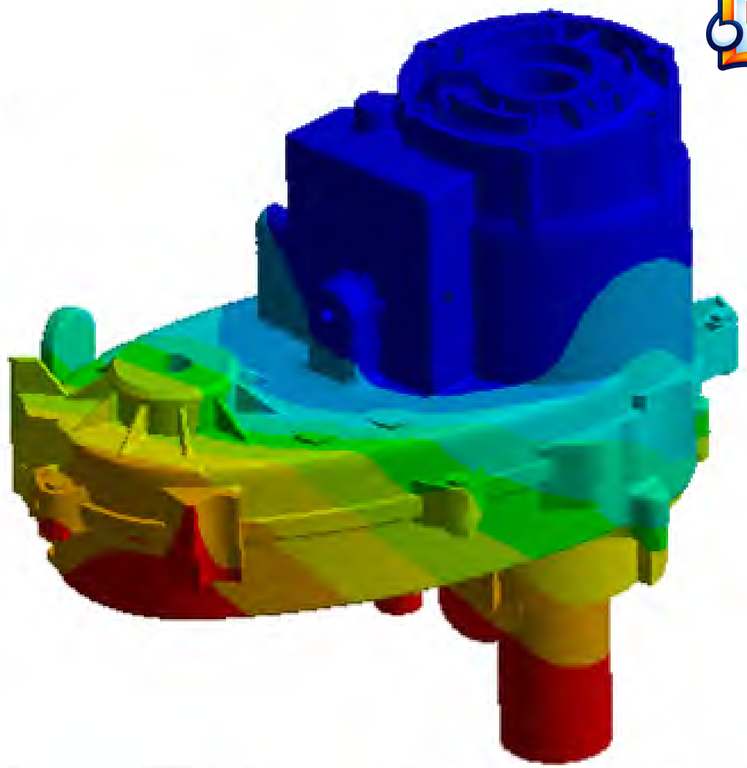
1 Hours

Practical Session

Self-Changing Project Work

Project #10 - Strength Analysis of Transfer Case Housing

- Complete Steup
- You have to create a detailed report and submit it to us for evaluation



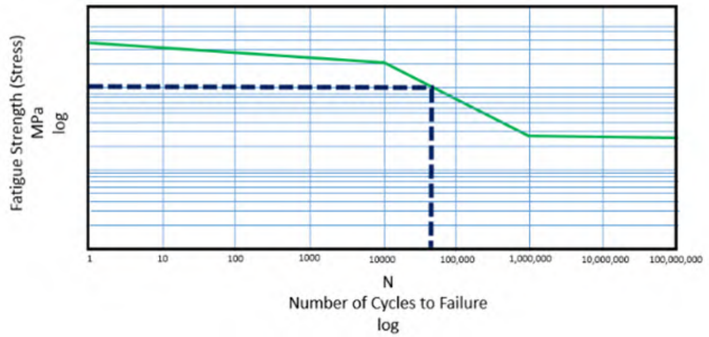
Lecture #48 (Theory Session)

Basics of Fatigue Analysis Concepts



45 Minutes





- What is Fatigue Failure
- What is Fatigue Analysis
- Two Structural Failure modes
- Why is Fatigue Analysis Important?
- Static Analysis vs Dynamic Analysis vs Fatigue Analysis -What is the Difference?
- What is Life and Why is Life Important
- Types of Fatigue Life
- What is Damage
- Means Stress Theories
- S-N Curve , Low Cycle Fatigue and High Cycle Fatigue
- Constant Amplitude Loading and Variable Amplitude Loading
- Safety Factor


A fracture oil tanker


Aloha Airlines Flight 243, Boeing 737-200,
April 28, 1988, Honolulu, Hawaii
(undetected cracks in fuselage skin)


Aloha Airlines Flight 243, Boeing 737-200,
April 28, 1988, Honolulu, Hawaii
(corrosion in the joint as a result of disbonding)

Lecture #49 (Project Work-11)



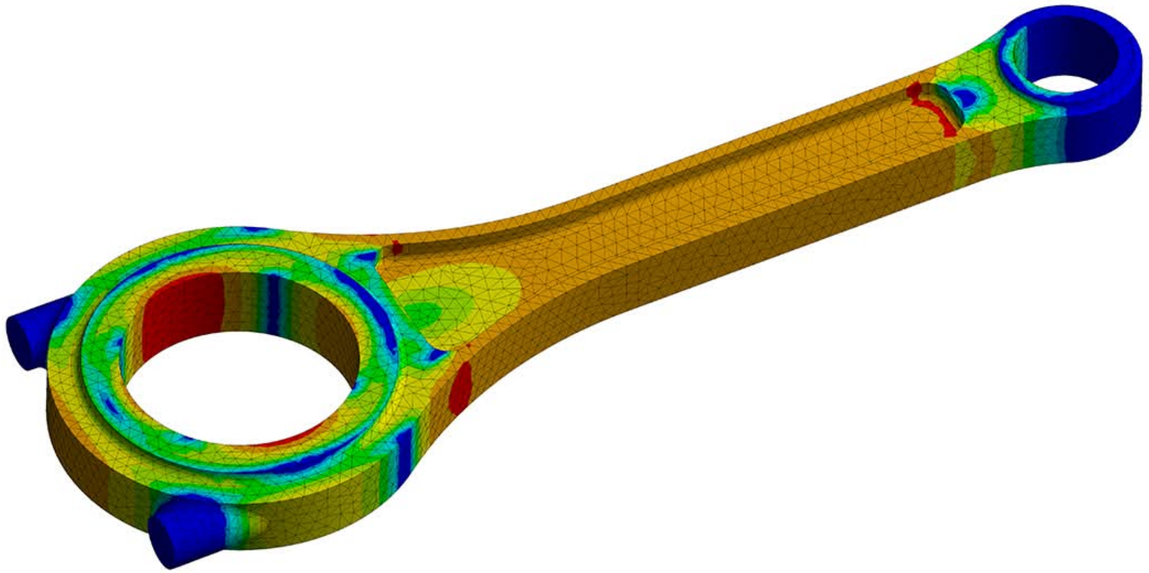
30 Minutes



Fatigue Analysis of Con-rod

Project #11 - Fatigue Analysis of Connecting Rod

- Fatige Analysis Setup
- Post-Processing, Results Discussion



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Ajay Singh Sisodiya
Founder & CEO of KI Technologies

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16+ YEARS OF INDUSTRY EXPERIENCE
Senior FEA consultant with expertise in **Automobile, EV, Off-Highway, Tractor, Machine Tool, Trailer and Defence Industries.**

EXPERTISE IN FEA/CAE
Linear & Nonlinear analysis, Thermal & Thermo-Mechanical analysis, Dynamic analysis and Fatigue & Durability analysis for **automotive & tractor engine development,** electric vehicle, powertrain components, heavy trailers, chassis and industrial machine tools & components.

WORKED ACROSS MULTIPLE INDUSTRIES
Automotive, Tractors, Trailer engineering, Electric Vehicles, Oil & Gas, Defence – including TATA 8x8 Kestrel Armoured Combat Vehicle, Rapid Deployment Surveillance System (Towed Special Purpose Equipment Platform for defence industry), trailers, engine and structural upgradation for ITL Tractor, locomotive component analysis for GE India, and EV/off-highway component development.

GLOBAL PROJECTS & CLIENTS
Delivered **200+** CAE/FEA projects for global clients including TATA Motor, GE India, Mahindra, ITL Sonalika Tractor, EBM Papst, Cooper Corporation, Premium Limited, Magna International, USA, Germany, Australia and many more. Supporting product development from concept through validation.

TRAINING & MENTORING
FEA training for **1,000+** engineers and students across **10+** countries, including IITs, NITs, and industry teams in the US, UK, France, Germany, Dubai, Singapore, Poland, Malaysia, Italy and Africa. That teaching work keeps my methodology sharp and current.

EDUCATION
Master's and Bachelor's Degrees in Mechanical Engineering from India.

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