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- Brief Explanation of FEA for a Stress Analysis Problem
- Finite Element Method vs Classical and Finite Difference Methods

2. Basic Equations in Elasticity

- Stresses in a Typical Element
- Equations of Equilibrium
- Strains
- Strain-Displacement Equations

3. Matrix Displacement Formulation

- Solution of Matrix Displacement Equations for:
- Finite Element solutions to Bars, Trusses, Beams and Frames
- Techniques of Saving Computer Memory Requirements

4. Element Shapes, Nodes, Nodal Unknowns and Coordinate Systems

5. Shape Functions

- Polynomial Shape Functions
- Convergence Requirements of Shape Functions
- Derivation of Shape Functions Using Polynomials
- Finding Shape Functions Using Lagrange Polynomials
- Shape Functions for Serendipity Family Elements
- Hermite Polynomials as Shape Functions
- Construction of Shape Functions by Degradation Technique

6. Strain-Displacement Matrix

- Strain—Displacement Matrix for Bar Element
- Strain Displacement Matrix for CST Element
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7. Assembling Stiffness Equation—Direct Approach

- Element Stiffness Matrix for CST Element by Direct Approach
- Nodal Loads by Direct Approach

8. Assembling Stiffness Equation—Galerkin's Method

- What is Galerkin's Thechnique, based on Virtual Work Method
- Galerkin's Method Applied to Elasticity Problems

9. Assembling Stiffness Equation—Variational Method

- What is General Variational Method in Elasticity Problems
- Potential Energy and Principles of Minimum Potential Energy in Elastic Bodies
- Rayleigh—Ritz Method, a Variational Formulation in Finite Element Analysis

10. Discretization of a Structure

- Nodes as Discontinuities
- Refining Mesh
- Use of Symmetry
- Finite Representation of Infinite Bodies
- Element Aspect Ratio
- Higher Order Element vs Mesh Refinement
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11. Finite Element Analysis—Plane Stress and Plane Strain Problems

- General Procedure when CST Elements are Used
- Use of Higher Order Elements

12. Isoparametric Formulation

- Coordinate Transformation
- Basic Theorems of Isoparametric Concept
- Uniqueness of Mapping
- Isoparametric, Superparametric and Subparametric Elements
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- Commercially Available Standard Packages
- Structure of a Finite Element Analysis Program
- Pre and Post Processors
- Desirable Features of FEA Packages

15. MATLAB PROGRAMMING as to apply to Matrix problems

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