

Introduction to Finite Element Method

ANSYS Design Modeler

- **1D**
 - Line modeling
 - Truss element
 - Beam element
 - Pipe element
- **2D**
 - Surface modeling
 - Plane stress element
 - Plane strain element
 - Shell element
 - Membrane element
- **3D**
 - Solid modeling
 - Solid elements

Material models

- **Elastic models**
 - isotropic
 - orthotropic
 - anisotropic
- **Plastic models**
 - Kinematic hardening
 - Isotropic hardening

Mesh generation

- **1D - 2D -3D mesh generation**
 - Methods
 - algorithms
 - mesh setting

Static structural analysis

- **Governing equations**
- **Boundary conditions**
- **Linear vs. non-linear analysis**
 - Analysis settings
 - Contact tools
- **Non-linear analysis**
 - Newton-Raphson algorithm
 - NL Material
 - NL geom
 - NL contact
 - Post-processing

Thermal analysis

- **Steady-state thermal analysis**
 - Governing equations
 - Boundary conditions
 - Dirichlet
 - Neuman
 - Material considerations
 - Mesh considerations
 - Linear vs non-linear thermal analysis
 - Material
 - Radiation
 - Heat transfer coefficient
 - Post-processing
- **Thermal stress analysis**
 - coupled
 - uncoupled

Buckling analysis

- **stability and instability**
- **Eigenvalue buckling**
 - P-delta graph
 - Bifurcation point
 - Post processing

- Mode shape
- Load multiplier
- Result interpretation
- **Intro to non-linear buckling**
 - Imperfection
 - UPGEOM command
 - Algorithms
 - Newton-Raphson
 - Stabilize
- Arc-Length

Design exploration

- **Parametric finite element model**
 - Parametric design
 - Parametric analysis
- **Design Of Experience [DOE]**
 - Sensitivity analysis
 - Correlation analysis
- **Meta models**
 - Response surface method [RSM]
- **Optimization**
 - Genetic Algorithm
- **Design methods**
 - Direct design
 - Inverse design
 - optimum design

Dynamic structural analysis

- **Damping**
 - Types of damping
 - Viscous
 - Material

- Coulomb
 - Numerical
 - Equation of motion
 - Rayleigh damping
 - Alpha damping
 - Beta damping
- **Modal analysis**
 - Governing equations
 - methods
 - Undamped modal
 - Damped modal
 - Natural frequency / damped frequency
 - Mode shapes
 - Participation factor
 - Effective mass
 - Damping control
 - Pre-stressed modal
- **Transient structural analysis**
 - Governing equation
 - Time-varying boundary conditions
 - Time integration Methods
 - Implicit
 - Explicit
 - Time step selection
 - Initial condition
 - Damping control
 - Solution techniques
 - Full method
 - Mode-superposition method
 - Post-processing
- **Response spectrum analysis**
 - Generation of Response spectrum
 - Displacement
 - Velocity
 - Acceleration

- Boundary conditions
- terminology
 - Participation factors
 - Mode coefficients
 - Response
 - Peak response
 - Zero period acceleration
- Modal analysis
 - Mode superposition
 - Mode combination methods
 - SRSS
 - CQC
 - ROSE
- Rigid response
- Missing mass response
- Post-processing

Intro to explicit dynamics