AutoCAD, SolidWorks, CATIA, ANSYS Track

Comprehensive Proficiency in CAD & FEA for Mechanical Design

Presented by: Sapiens AI Team

Program Goal & Core Topics

Program Goals

Comprehensive Proficiency in Industry-Standard Software

Gain a deep understanding and practical mastery of leading CAD software, including AutoCAD, SolidWorks, and CATIA.

Our training focuses on world-leading "3D parametric, associative & feature based modeling software," ensuring real-world project readiness.

Introduction to Finite Element Analysis (FEA) with ANSYS

Learn foundational FEA concepts and applications using ANSYS for static, thermal, and modal simulations.

Cover "Static Structural, Modal," and thermal analyses, utilizing "Ansys Mechanical" as an "integrated platform" for robust "structural analysis."

Culminating Project for Practical Application

Apply acquired skills to design a complete mechanical assembly and perform fundamental FEA simulations on it, bridging theory with practice.

🔧 Core CAD Topics

Basics   CAD Software Basics & Interface Navigation.

Modeling   2D Drafting & 3D Modeling Techniques.

📊 Core FEA & Mini Project

FEA Intro   Introduction to FEA with ANSYS & Simulation Basics.

Optimization   Design Optimization & Drafting Standards.

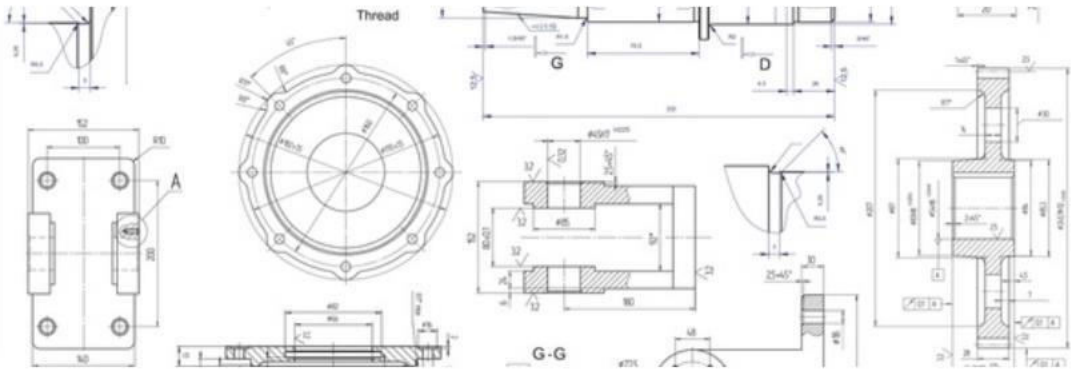# Phase 1: Foundational & Core Concepts (Online)

📅 **Phase Duration**

Month 1   Month 2

Foundational & Core Concepts

Phase Goal: Building Core Competencies
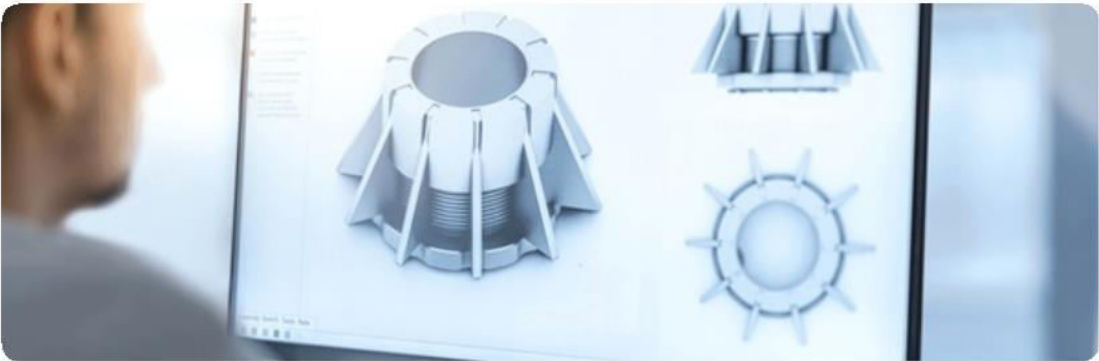

Mastering 2D Drafting Principles

Develop a robust understanding of fundamental drafting techniques and standards.

Insight: As industry experts note, "AutoCAD is good in 2D" for precise technical drawings. This phase ensures proficiency in creating foundational blueprints.

Foundational Skills in 3D Part Modeling

⊞ Key Software Proficiency

AutoCAD

Focus on 2D drafting, technical drawing creation, and basic 3D visualization.

Importance: Essential for establishing a strong base in precision drawing.

SolidWorks

Introduction to 3D parametric modeling and part design.

Coverage: Training will encompass vital modules like "Part Design, Assembly

Month 1: 2D Drafting with AutoCAD

○——————————————●——————————————○
                    Week 1 Focus   **Week 2 Focus**

🎓 Week 1: Fundamentals & Basic Commands

› **Intro to AutoCAD & CAD Fundamentals:** Grasp the core interface and foundational principles. AutoCAD is a leading 2D drafting tool.

› **Basic Drawing & Editing:** Master essential commands like `Line` , `Circle` , `Trim` , `Copy` , and `Rotate` .

› **Organization & Annotation:** Use `Layers` for organization, `Blocks` for reusable components, and add `Dimensions` & `Text` .
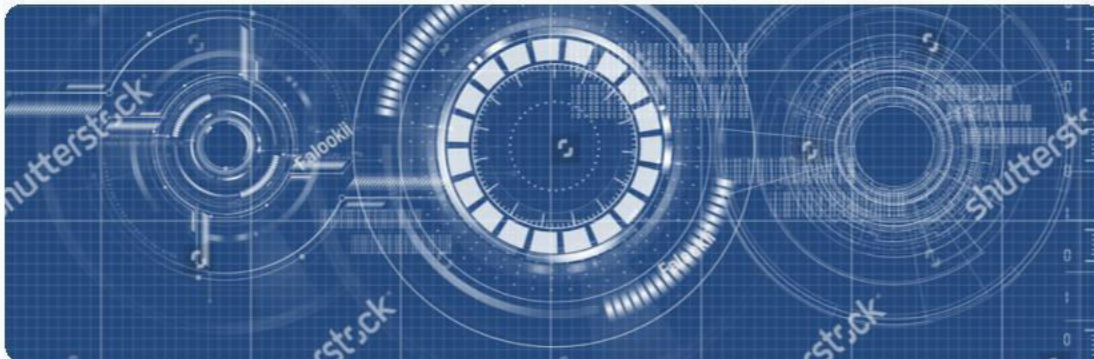
✏ Week 2: Advanced Techniques & Detailing

› **Advanced 2D Techniques:** Create `Sectional Views` to reveal internal features and apply `Auxiliary Views` for inclined surfaces.

› **Detailing Practices:** In-depth study of `Dimensioning` standards, introduction to `Tolerancing` for manufacturing, and mastering `Plotting & Printing` for professional output.

Hands-on exercises will focus on creating detailed 2D production drawings with sections, dimensions, and basic tolerances, preparing you for real-world engineering documentation.

Month 1: Basic 3D Part Modeling (SolidWorks/CATIA)

Week 3: Parametric CAD & Sketching
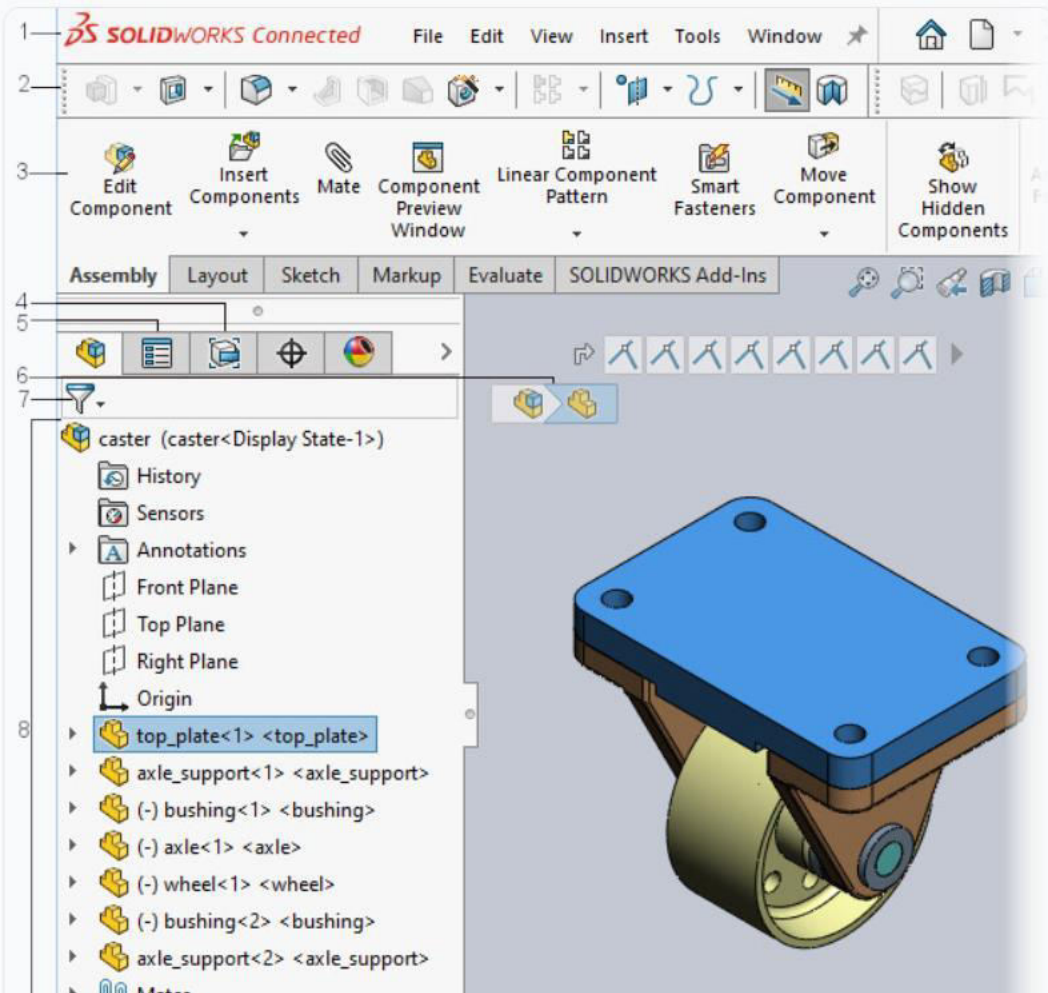
Week 4: Core Features & Part Refinement

Source: Mechanical Robot Arm on Assembly Line in Factory, Futuristic AI ...

Feature-Based Modeling

Understanding features as the building blocks of 3D models and using the Design Tree for efficient model management.

Month 2: Advanced 3D Part Modeling (SolidWorks/CATIA)

Week 5: Advanced 3D Feature Mastery

Complex Feature Creation

Crucial for intricate, organic, or non-uniform geometries that define advanced product design.

Swept Boss/Cut: Creates features by sweeping a profile along a path (e.g., pipes, tubes).

Lofted Boss/Cut: Blends multiple profiles to create smooth, complex shapes (e.g., aerodynamic surfaces).

Specialized Features for DFM

Address common engineering challenges, optimizing parts for function and production.

Rib: Adds thin-walled supports for stiffness.

Draft: Applies taper for mold ejection.

Hole Wizard: Automates standard hole creation.

Efficient Design Duplication

Intelligently duplicates features to significantly reduce modeling time.

Linear Pattern: Duplicates features in a straight line.

Circular Pattern: Duplicates features around an axis.

Sketch-Driven: Places features based on sketch points for custom arrangements.

Hands-on Application

Integrated Projects: Learners design and model complex industrial components from scratch.

Feature Integration: Apply Swept, Lofted, Rib, Draft, and Pattern tools in combination.

Real-World Scenarios: Projects focus on creating realistic, functionally optimized, and manufacturable parts.

The Strategic Impact of Advanced 3D Modeling

Unleashed Design Potential
Enables complex, aesthetically superior

Enhanced Manufacturability
Reduces production errors and waste.

Accelerated Design Cycles
Speeds up iterations and time-to-market.

Foundation for Analysis
Produces robust models for high-fidelity

Month 2: Assembly Design & CAD Best Practices

Week 6: Assembly Design

Assembly Environment Mastery

Techniques for inserting components and defining relationships using standard mates (Coincident, Concentric) and advanced mates (Width, Path) for controlled motion.

Sub-Assemblies for Scalability

Strategies for organizing large assemblies into manageable units, improving performance and clarity using top-down or bottom-up approaches.

Source: IFS Academy

Week 7: Surface Modeling

Foundations of Surface Modeling

Understanding when to use surfaces for complex, organic shapes common in consumer products and automotive design.

Surface Creation & Editing

Hands-on practice with Extrude, Revolve, Sweep, and Loft surfaces. Master editing tools like Trim, Extend, and Knit for precise control.

Source: IFS Academy

Week 8: GD&T & Drawings

GD&T Refresher

Review Feature Control Frames, Datums, and tolerances (Form, Orientation, Position, Profile) for manufacturing precision.

CAD Best Practices

Learn Design Intent, Configuration Management, and generating professional drawings with BOMs from 3D models.

Source: Innovians Technologies

Phase 2: Industry Immersion & Integrated Project (Offline)
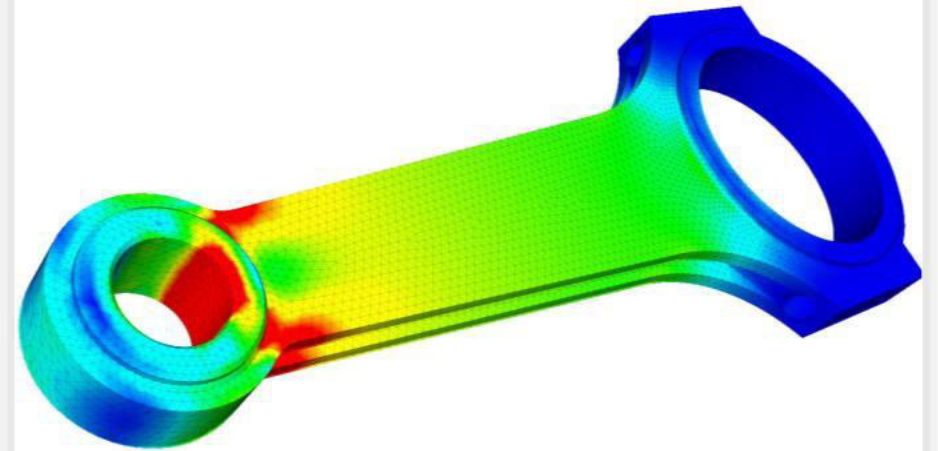
Month 3
Industry Immersion & Integrated Project

🦾 Core Focus: FEA Principles & Project Application

Understanding FEA Principles: Gain deep comprehension of Finite Element Analysis fundamentals, covering driving theories and methodologies for structural analysis including Static, Modal, and Buckling physics.

Applying Skills to Project: Bridge theoretical knowledge with hands-on problem-solving by applying simulation skills to a complete mechanical assembly project in a real-world context.

> **Insight:** As industry experts suggest, "Ansys for analysis" is crucial for "all larger stuff and anything beyond really basic" mechanical problems.

Key Software - ANSYS Workbench Proficiency: Master the Ansys Workbench platform to integrate data across simulations, creating more accurate models efficiently.

👷⚙️ Capstone Mini Project

Integrated Application   Synthesize CAD and FEA knowledge into a single, comprehensive project.

🚀 Career Launchpad Workshops

Industry Insights   Engage with experts on market trends and job demands in CAD/FEA.
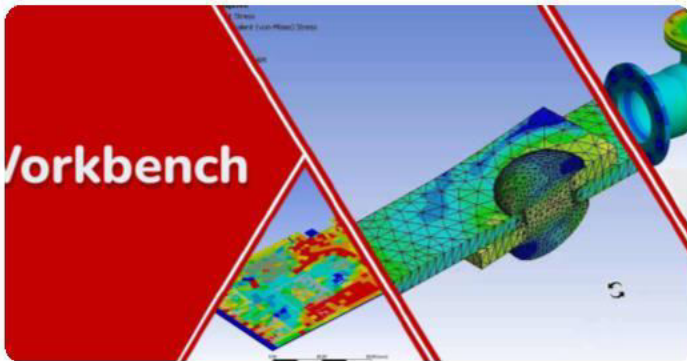
Month 3: ANSYS FEA Fundamentals
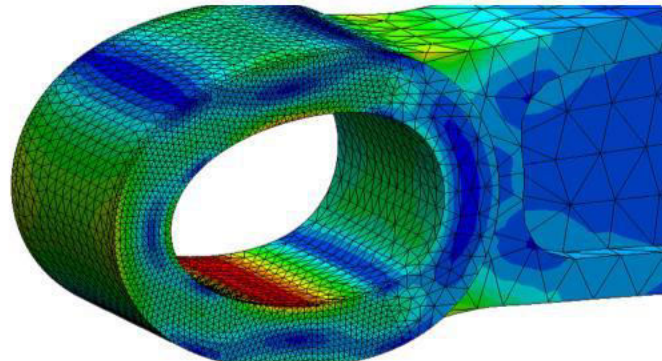
1. FEA Concepts & Workbench

Concepts Understand the "driving theories behind engineering, including finite element analysis (FEA)."

Discretization Learn how systems are broken into discrete elements for analysis.

Workbench Navigate the ANSYS UI, project schematic, and import/cleanup CAD models.
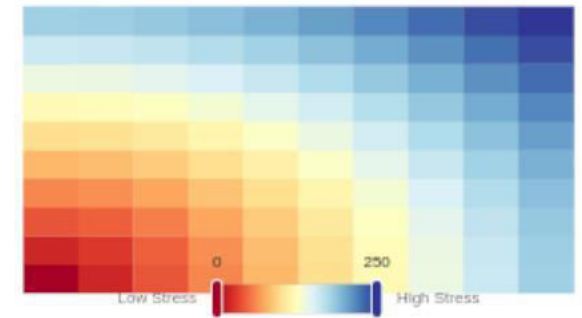
2. Meshing Optimization

Density Control Refine mesh in critical regions to improve accuracy and manage computational cost.

Element Quality Evaluate metrics like aspect ratio and skewness to ensure reliable simulation results.

Properties Assign accurate material properties (Young's Modulus, Poisson's Ratio)

3. Static Structural Analysis

Conditions Apply realistic constraints (fixed supports) and loads (force, pressure).

Post-processing Visualize & interpret key results like Von Mises stress, strain, and deformation.

Hands-on Perform static structural analysis on CAD parts from import to post-processing.
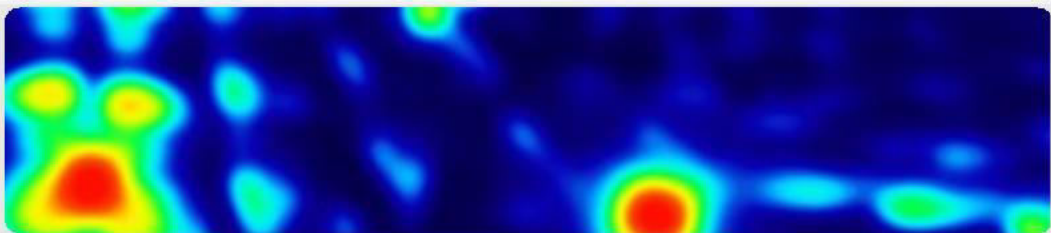
Month 3: Thermal, Modal & Optimization

Week 10: Thermal & Modal Analysis | **Week 11: Optimization & Reporting**
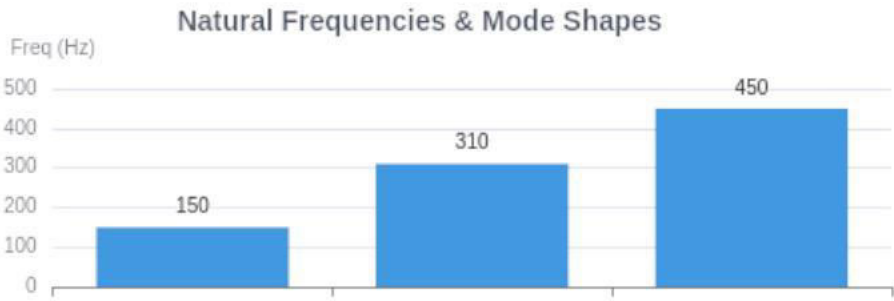
🧪 Week 10: Thermal & Modal Analysis

Thermal Analysis

Understanding heat transfer principles: **Conduction**, **Convection**, and **Radiation**. This involves simulating **Temperature Distribution** to predict thermal stresses and manage heat dissipation.

Modal Analysis

Identifying a structure's **Natural Frequencies & Mode Shapes** to avoid resonance and ensure dynamic reliability.

Natural Frequencies & Mode Shapes

Freq (Hz)

500
400
300 — 310
200
150
100
0

450

✦ Week 11: Design Optimization & Reporting

Design Optimization Concepts

Weight Reduction via Optimization

Weight (kg)

10 kg

10
8
6
4
2
0

7 kg

Initial Design   Optimized Design

Systematically improving designs using methods like **Topology Optimization**, **Shape Optimization**, and **Parametric Studies**.

Result Interpretation & Professional Reporting

Translating complex simulation data into actionable insights through:

✓ **Validation:** Critically assessing results against specifications.

👁 **Visualization:** Using plots and contours to highlight key findings.

📄 **Reporting:** Creating clear engineering reports for stakeholders.

Capstone Mini Project
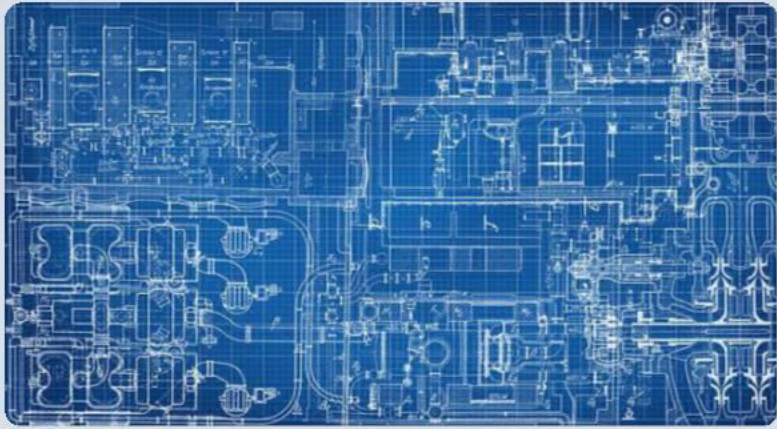
Integrate CAD Modeling & FEA Simulation Skills

This project is the culmination of your journey, merging advanced CAD design with Finite Element Analysis. It's a hands-on opportunity to bridge theory and practice, mirroring industrial workflows where, as noted, "SolidWorks uses the ANSYS MAPDL solver for mechanical problems," emphasizing integrated software expertise.

Phase 1: CAD Modeling

Detailed Design: Model a chosen mechanical assembly in SolidWorks or CATIA.

Software Proficiency: Reinforce advanced skills in part modeling and sub-assemblies.

Design Intent: Focus on robust, manufacturable models for accurate analysis.

Phase 2: FEA Setup

The "Ansys Workbench platform lets you integrate data across engineering simulations to create more accurate models more efficiently."

Model Preparation: Import and clean CAD geometry in ANSYS Workbench.

Pre-processing: Define materials, meshing strategies, and realistic component connections.

Phase 3: Perform Analysis

Phase 4: Post-processing & Report

Career Launchpad & Program Conclusion

📈 Your Journey to Professional Excellence

The program prepares you not just with technical skills, but also with the essential tools and strategies for a successful career launch.

Career Readiness Metrics

Preparedness Level (%)

	Resume\nEffectiveness	Networking\nConfidence	Interview\nPreparedness	Portfolio\nImpact
	85%	90%	88%	92%

📄 Resume & Portfolio

Tailored Craft resumes for Design Engineers & CAE Analysts.

Impactful Develop a portfolio showcasing your CAD & FEA projects.

👥 LinkedIn & Networking

Branding Optimize your LinkedIn profile for maximum visibility.

Strategy Learn to connect with industry leaders and recruiters.

💬 Mock Interviews

🔗 Industry Networking

✅ Program Conclusion

Your dedication culminates in this significant milestone, marking your readiness for the engineering world.

🎖️ Graduation & Certification

Formal Celebration A ceremony celebrating your successful completion of the program.

Official Recognition Receive your certification, validating your expertise and skills.