

Advanced Reverse Engineering with Autodesk Inventor

Target Audience

This course is designed for engineers, CAD designers, and product development professionals who want to master **reverse engineering workflows** using point cloud processing, mesh optimization, and parametric CAD modeling. It is ideal for learners working in automotive, aerospace, industrial equipment, and manufacturing industries where Scan-to-CAD workflows are essential.

Course Outcomes

By the end of this 4-day course, participants will be able to:

- Understand industrial reverse engineering workflows.
- Process point cloud data using **CloudCompare**.
- Clean and optimize scan datasets in **Autodesk ReCap Pro**.
- Import scan data into **Autodesk Inventor**.
- Create accurate parametric CAD models.
- Reconstruct complex surfaces and freeform geometry.
- Validate CAD models against scanned geometry.
- Generate manufacturing-ready engineering drawings.
- Execute a complete Scan-to-CAD reverse engineering project independently.

Course Outline

The course comprises **32 hours** of theory and labs and is divided into 12 different chapters. Each chapter will be followed by hands-on lab exercises to reinforce learning and gauge understanding of the topics covered.

Table of Contents

Day 1 – Point Cloud Fundamentals & CloudCompare

Module 1: Introduction to Reverse Engineering

- Reverse engineering workflow
- Applications in manufacturing and product design
- Point cloud, mesh, and CAD concepts
- Types of 3D scanners
- Scan-to-CAD workflow
- File formats (LAS, E57, PLY, XYZ, STL, OBJ)

- *Lab 1:* Understanding reverse engineering workflow, exploring sample scan datasets

Module 2: CloudCompare Fundamentals

- CloudCompare interface
- Importing point clouds
- Navigation and visualization
- Display settings
- Working with multiple datasets
- File management
- *Lab 2:* Import and visualize scanned data

Module 3: Point Cloud Processing in CloudCompare

- Noise removal
- Cropping and segmentation
- Registration and alignment
- Merging scans
- Coordinate systems
- Measuring point clouds
- Normal calculation
- Sampling and decimation
- Exporting cleaned datasets
- *Lab 3:* Clean and align multiple scans, export optimized point cloud

Day 2 – Autodesk ReCap Pro

Module 4: Autodesk ReCap Pro Essentials

- User Interface
- Project creation
- Importing point clouds
- Registration review
- Scan regions
- Coordinate management
- Project organization
- *Lab 4:* Create a ReCap project

Module 5: Point Cloud Optimization in ReCap

- Region selection
- Clipping
- Cleaning unwanted objects
- Scan indexing
- Navigation tools
- Annotation
- Measurements
- Quality verification
- Export formats
- *Lab 5: Prepare point cloud for CAD modeling*

Module 6: Preparing Data for Inventor

- Export options
- Coordinate alignment
- Managing large datasets
- Mesh generation overview
- Best practices
- Workflow optimization
- *Lab 6: Export point cloud for Autodesk Inventor*

Day 3 – Autodesk Inventor Reverse Engineering

Module 7: Importing Scan Data

- Supported file formats
- Import workflow
- Positioning scan data
- Reference geometry
- Work planes and axes
- Section analysis
- *Lab 7: Prepare scan data inside Inventor*

Module 8: Parametric Reverse Engineering

- Creating sketches from scans

- Project Geometry
- Constraints and Dimensions
- Extrude, Revolve, Sweep, Loft
- Hole features and Patterns
- *Lab 8:* Model a mechanical component from scan data

Module 9: Surface Modeling

- Surface tools
- Boundary surfaces
- Patch surfaces
- Loft surfaces
- Surface trimming
- Stitching and Thickening
- Surface repair
- *Lab 9:* Reconstruct freeform geometry

Day 4 – Validation & Industrial Project

Module 10: Model Refinement

- Editing features
- Parametric modifications
- Feature suppression
- Design intent
- Model optimization
- Best practices
- *Lab 10:* Refine CAD model

Module 11: Validation & Manufacturing Documentation

- Compare CAD with scan
- Dimensional verification
- Deviation analysis
- Inspection workflow
- Engineering drawings
- GD&T basics

- Section and detail views
- PDF and DWG export
- *Lab 11:* Validate model and create manufacturing drawings

Module 12: Industrial Capstone Project

- Import raw scan data
- Clean point cloud in CloudCompare
- Process and organize scans in Autodesk ReCap Pro
- Export optimized scan data
- Create parametric CAD model in Autodesk Inventor
- Surface reconstruction
- Validation against scan data
- Engineering documentation
- Final project review
- *Capstone Lab:* End-to-end reverse engineering of a mechanical part from raw point cloud to production-ready Autodesk Inventor model