

Additive Manufacturing Foundations

Design, materials, processes and practical 3D printing

FA-0661 · 2 days

Others

Introduction

An introductory course exploring the additive-manufacturing workflow from a digital design to a printed part. Participants compare representative polymer and metal processes, consider material and design constraints, and practise a small design-to-print workflow in a prepared learning environment.

Hands-on work uses one available printer and material; other processes and industrial applications are examined through demonstrations and case studies. Two days provide foundations, not qualification to manufacture certified aerospace or medical components.

Learning outcomes

- Explain the principal additive-manufacturing process families and compare representative applications.
- Identify design, orientation, support and material considerations for a simple part.
- Prepare and review a small model for an available 3D-printing process.
- Describe common post-processing and quality checks, including the limits of a learning prototype.

Prerequisites

- Basic familiarity with manufacturing concepts is helpful.
- Prior CAD experience is useful but not required; a prepared example is provided.
- Use the arranged CAD/slicing tools and supervised printer environment.

Training outline

1. Day 1 — Processes, Design and Materials

Additive-Manufacturing Fundamentals

- Layer-by-layer workflow, digital models, slicing and the development of 3D printing.
- Material extrusion, vat photopolymerisation, powder-bed fusion, binder jetting and material jetting; representative FDM, SLA, SLS, laser-metal and vendor-specific processes.
- Compare mechanisms, machine components, materials, applications and practical limitations.

Design for Additive Manufacturing

- Introduction to DfAM Principles
 - Considerations for Additive Manufacturing
 - Design complexity and customization
 - Part orientation and support structures
 - Minimizing material usage and print time
- Software Tools for Additive Manufacturing Design
- Case Studies: Real-world DfAM Examples

Materials and Process Selection

- Overview of Materials Used in Additive Manufacturing
 - Plastics and Polymers
 - Metals and Alloys
 - Ceramics and Composites
- Material Selection Criteria for Additive Manufacturing
- Properties and Applications of Various Materials

2. Day 2 — Quality, Applications and a Design-to-Print Exercise

Process Comparison

- Detailed Exploration of Key Additive Manufacturing Technologies
 - Process Mechanisms

- Machine Components and Operation
- Applications and Case Studies for Each Process
- Comparative Analysis of Additive Manufacturing Technologies

Post-Processing and Quality

- Overview of Post-Processing Requirements
- Techniques and Tools for Post-Processing
 - Cleaning and Support Removal
 - Surface Finishing Methods
 - Heat Treatments and Other Post-Processing Methods
 - Quality Control and Testing
- Quality Assurance in Additive Manufacturing
- Testing Methods for Additive Manufactured Parts
- Standards and Certification in Additive Manufacturing

Post-processing and inspection depend on the material and process. Discuss standards and qualification as context; this course does not certify parts or operators.

Applications and Case Studies

Industry-specific Applications

- Aerospace and Defense
- Medical and Dental
- Automotive
- Consumer Products
- Emerging Trends and Future of Additive Manufacturing

Treat sector examples as illustrative and assess suitability against cost, repeatability, material properties and qualification requirements.

Practical Session

- Hands-on Experience with 3D Printing
- Designing a Simple Object for 3D Printing
- From Design to Print: A Step-by-Step Guide
- Conclusion and Future Outlook
- Recap of Key Learning Points
- Discussion on the Future of Additive Manufacturing

- Q&A Session

Design or adapt a simple part, inspect orientation and supports, prepare a print and review the result.
Printer safety and material handling follow the prepared lab's instructions.