Course AM-1
Introduction to Additive Manufacturing

Course Summary

AM1 is a hands-on introduction to additive manufacturing (AM) with a focus on Material Extrusion processes, including Fused Deposition Modeling (FDM) and Fused Filament Fabrication (FFF), as applied to tooling, fixtures, repair support, prototype development, and low-volume manufacturing. Designed for technicians, engineers, educators, and manufacturing personnel, this course develops practical skills in the operation, troubleshooting, maintenance, and application of polymer-based 3D printing systems. Participants learn how to transform digital designs into functional printed components while understanding the relationship between machine settings, materials, part geometry, and final part performance.

Introduction

Through a structured progression of lectures and hands-on workshops, students learn how 3D printers work, how to select appropriate materials and print settings, how to identify and solve common printing problems, and how to design simple functional components using Computer-Aided Design (CAD) software. Instruction emphasizes practical decision-making, including printer capabilities and limitations, print quality expectations, design sourcing and evaluation, design-for-additive-manufacturing principles, and preventive maintenance practices.

Topics

Lecture Topics:

Fundamentals of additive manufacturing and the seven families of 3D printing; Fused Deposition Modeling (FDM) and Fused Filament Fabrication (FFF) processes; printer hardware, materials, and safety; slicer software fundamentals and print preparation; part orientation, support structures, and first-layer strategies; material selection and print performance; printer capability versus product expectations; sourcing and evaluating existing designs; design-for-additive-manufacturing principles; geometry, anisotropy, wall thickness, load paths, and feature orientation; diagnosing print defects and failure analysis; troubleshooting methodologies; preventive maintenance and reliability; calibration procedures; Computer-Aided Design (CAD) fundamentals and manufacturing intent.

Workshop Exercises

Baseline print preparation and evaluation; slicing and optimizing existing models; sourcing and evaluating third-party designs; diagnosing failure modes related to geometry, orientation, slicer settings, and materials; iterative print improvement through re-slicing and validation; creating a simple functional part using CAD; manual bed leveling; filament replacement; nozzle replacement; hot-end replacement; cleaning and lubrication procedures; calibration and maintenance activities; final design, print, and evaluation of a functional component.

Course Benefits

Participants develop the ability to independently prepare, execute, evaluate, troubleshoot, and maintain FDM/FFF 3D printing systems. Students learn to make informed decisions regarding materials, print settings, and design strategies while gaining practical experience identifying and correcting print defects. Graduates of the course leave with the knowledge and confidence to apply additive manufacturing technology for tooling, fixtures, prototypes, repair support components, and other functional applications.

Prerequisites

No prior additive manufacturing experience required. Basic familiarity with manufacturing, engineering, fabrication, basic computer file explorer knowledge, or composites is recommended.

Teaching Method

Active classroom lecture and workshop exercises: 40% theory and 60% practical.

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