Wohlers Associates, Inc.

Three-Day DfAM Course Outline

Hands-on exercises Presentations/discussions

Day 1		
8:30-8:45	Introduction	Introduction to the course and attendees.
8:45-9:30	State of the AM industry	Recent AM growth trends and developments around the world.
9:30-10:15	Introduction to design for AM	Benefits of AM in the context of DfAM, how AM is being applied, and how certain parts can be designed for AM.
10:15-10:45	Break	
10:45-11:30	AM process: from CAD to part	Examining the complete AM process chain, from CAD part creation, to part production. Attendees will gain an understanding of the entire process chain and how it helps them to design better AM parts. It includes file formats and working with STL manipulation software.
11:30-12:00	Part consolidation exercise	Hands-on exercise on the implications of part consolidation for AM.
12:00-12:45	Lunch	
12:45-1:15	Support minimization exercise	Optimize a part to be printed with minimal support, or none at all.
1:15-2:30	AM design optimization exercise	Thought processes behind DfAM. In this exercise, participants will design a hydraulic manifold while considering print orientation and support material.
2:30-3:0	Break	
3:00-4:00	Design for mass-customization exercise	Hands-on exercise to design a custom product using a combination of CAD, 3D scanning, and STL editing software. This exercise introduces attendees to working with multiple software tools and technologies to produce custom parts optimized for AM.
4:15-5:30	Cocktail reception next door at Tavern West	
Day 2		
8:00-9:00	Designing for metal AM	Specific issues and guidelines around designing for metal AM, including anisotropy, process constraints, general guidelines related to wall thicknesses, hole sizes, tolerances, angles, etc. A close look at metal AM post-processing and material properties.
9:00-9:30	Lattice structure exercise	A solid part is transformed into a shell filled with a lattice structure.
9:30-10:00	Break	
10:00-10:30	Designing for metal AM (continued)	Continuation of previous session.
10:30-11:00	Metal AM build simulation	Risks of build failure can be reduced using distortion simulation software.

11:00-11:45	Economics of AM	When does it make sense, or not make sense, to use AM for production quantities? What determines AM costs and how are parts designed to minimize cost?
11:45-12:00	Economics of AM exercise	Apply costing models to calculate a part's cost with AM.
12:00-12:45	Lunch	
12:45-1:30	Designing for polymer AM processes	Specific issues and design guidelines surrounding polymer AM (material extrusion, LS, SL, etc.), including post-processing.
1:30-2:00	Topology optimization	Designing topology-optimized parts for AM, and creating light-weight parts using software such as Inspire from solidThinking. The workflow of topology optimization, setting up multiple load-cases, and then using the generated ideas to produce a final design.
2:00-2:20	Break	
2:20-4:00	Topology optimization (continued)	Continuation of previous session.
Day 3		
8:00-8:30	Tooling applications of AM	AM beyond direct part production: Tools for injection-molding, sheet-metal forming, cutting and drilling, extrusion, jigs and fixtures, etc. Adding fixtures to parts to ease mounting on CNC machines for more efficient post-processing.
8:30-9:30	Putting it all together	Hands-on exercise on designing a product that can be printed in metal with minimal support material and post-processing. The exercise applies what has been learned over the past three days.
9:30-9:45	Break	
9:45-11:00	Putting it all together (continued)	Continuation of previous session.
11:00-11:30	Practical lessons in AM with Doug Collins	Lessons learned at Avid Product Development using HP Multi Jet Fusion and other AM technologies.
11:30-12:15	Lunch	
12:15-1:15	DfAM expert panel session	A group of AM experts offer opinions and answer questions from participants.
1:15-1:45	Break	
1:45-2:45	AM in the future	Looking at where AM and design software tools are headed in the future and how they may impact DfAM.
2:45-3:00	Conclusion	Closing comments and distribution of certificates of completion.

Design for Additive Manufacturing