

CREO AND DESIGN FOR ADDITIVE MANUFACTURING

Jose Coronado Lara Director, CREO Manufacturing Solutions



forum europe





Take Action	Take Action			Conclusion e		
AM Drives	Lightweight	Topology	Additive	Wrap-Up		
Digital	designs with	optimized	Manufacturing			
Transformation	lattices	designs	in Metal			

AM DRIVES DIGITAL TRANSFORMATION

📚 ptc

Digital Transformation of Product Engineering & Manufacturing

Design and produce innovative parts with predictable quality at competitive cost anywhere in the world, fast time-to-market, embedded in conventional production lines

Radically transform supply chain and logistics for new production, as well as spare and repair parts

Additive Manufacuring is a unique enabler

The most direct conversion of a **digital definition** into the **physical product**

Complex geometries, consolidated parts, low/no maintenance components

Minimal tooling or setup time needed

Digital AM Equipment can be virtually connected and managed

Digital Part Definition with material spec, parameters and process to print a part

Print (spare or repair) parts **on-demand** from a virtual inventory



... AND PTC ENABLES ADDITIVE MANUFACTURING

Unleash the new Design Opportunities with Advanced DfAM capabilities (Design for Additive Manufacturing)

•Advanced Lattices

- Topology Optimization
- Print preparation, Build Position and Tray Assembly

Lifecycle-manage , printable parts' and all related information and processes end-to-end

Global collaboration, traceability, process/workflow and version control
Additive MBOM with geometry, material, parameters, build tray assembly, process plan
Certificate of Conformity and digital twin (as manufactured)

Scale and Industrialize through Industial IoT connectivity

- Additive Production Management with scheduling, operator instructions, progress monitoring
- Connect Additive Manufacturing with conventional manufacturing processes









... AND PTC ENABLES ADDITIVE MANUFACTURING





Unleash the new Design Opportunities with Advanced DfAM capabilities (Design for Additive Manufacturing)

• Advanced Lattices

Topology Optimization

• Print preparation, Build Position and Tray Assembly





windchill[®] Lifecycle-manage ,printable parts' and all related information and processes end-to-end

Global collaboration, traceability, process/workflow and version control
Additive MBOM with geometry, material, parameters, build tray assembly, process plan
Certificate of Conformity and digital twin (as manufactured)



Scale and Industrialize through Industial IoT connectivity

- Additive Production Management with scheduling, operator instructions, progress monitoring
- Connect Additive Manufacturing with conventional manufacturing processes



... AND PTC ENABLES ADDITIVE MANUFACTURING





Unleash the new Design Opportunities with Advanced DfAM capabilities (Design for Additive Manufacturing)

• Advanced Lattices

Topology Optimization

• Print preparation, Build Position and Tray Assembly





windchill[®] Lifecycle-manage , printable parts' and all related information and processes end-to-end

Global collaboration, traceability, process/workflow and version control
Additive MBOM with geometry, material, parameters, build tray assembly, process plan
Certificate of Conformity and digital twin (as manufactured)





- Additive Production Management with scheduling, operator instructions, progress monitoring
- Connect Additive Manufacturing with conventional manufacturing processes

















📚 ptc



📚 ptc



📀 ptc

ADDITIVE MANUFACTURING FOR DESIGNERS AND CAD \$ ptc

Designing for Additive Manufacturing creates **new requirements**



Lightweight Structures

Lattice Features, without compromising stress and displacement requirements.

- Parametrically controlled
 lattice structures
- Optimization of lattice structures



A Tray Assembly, data managed in the PLM system

• The Tray Assembly is a repository for the additive manufacturing information.



Connectivity between CAD and the printers

 For supported printers, connectivity allows a bidirectional exchange of information.

ADDITIVE MANUFACTURING FUNCTIONALITY

Capabilities:

- Automated creation of lattice structures
- Full B-rep geometry
- Single feature with parametric control over all aspects of the lattice structure
- Complete control of Lattice Structure
 - 2 1/2D Lattice: Define configuration, cell type, size, wall thickness
 - **3D Lattice**: Define configuration, cell type, beam size/shape, ball diameter and density







ADDITIVE MANUFACTURING FUNCTIONALITY

Capabilities:

- Seamless analysis and optimization of lattice structures
- Integrated analysis with FEA Simulations
 - Single environment to analyze and optimize lattice structure
- Idealized elements for faster analysis
 - Automatic conversion of 3D lattice into beams, masses and shells
 - Automatic Beam end-point creation for Load and Constraint placement control







ADDITIVE MANUFACTURING FUNCTIONALITY

Printers •



Capabilities:

Print Tray optimization

🕌 Arrange on Tray

here in the second seco

Automatically position the models on the tray, using the 3D printer definition.

Manual Placement

Arrange the models on the Tray.

- Rapidly place and pattern models
- Auto Positioning (option)
 - Auto arrange models on the tray
- Nesting
 - Automatically position all the models to utilize the tray volume









Fully-integrated in PTC Creo C7.R Designed and built: Pratt & Miller

Semi-Automatic CAD Reconstruction

Powered by VR&D

•

•

Topology Optimization

Easy to setup and use

In partnership with:









😵 ptc





NEW PRODUCT INTRODUCTION IN THE ROADMAP

INTRODUCTION TO TOPOLOGY OPTIMIZATION

📚 ptc

• Topology optimization is a type of optimization that finds the best material distribution in a given design space



CREO TOPOLOGY OPTIMIZATION WORKFLOW



• Reduce weight, Improve performance, and Innovate



FAMILY OF FABRICATION CONSTRAINTS



Filling (Castings)					
	FGZ	FBZ	FTZ	FSZ	FOZ
Extrusion and Uniforms	EZ	UZX	UXYZ		
Stamping	SBZ	SIZ	S2Z		
Radial Filling					
	RGZ	RBZ	RTZ		
Radial Spokes	KZ				
Mirror, Cyclic and Periodic Symmetry	MIX	C C	PX	POX	
Minimum & Maximum Member Size	Min	Max			

Forward Looking Information is Subject to Change © 2018 PTC

TOPOLOGY OPTIMIZATION



• Fully embedded into Creo, results converted into freestyle object











NEW PRODUCT INTRODUCTION IN THE ROADMAP



Build Processor Framework

- Powered by Materialise
 - Profile Manager
 - Machine profiles & Build Configurations
- Connectivity between Creo and the Build Processor via APIs

In partnership with:







Forward Looking Information is Subject to Change © 2018 PTC

NEW PRODUCT INTRODUCTION IN THE ROADMAP

Support Generation (Metals)

In partnership with:





📀 ptc

NEW PRODUCT INTRODUCTION IN THE ROADMAP



Support Generation (Metals)

- Fully-integrated in PTC Creo
- Powered by Materialise
 - Materialise Magics is the de facto standard to generate AM supports
- Semi-automatic support generation for metal

In partnership with:





GENERATING SUPPORT STRUCTURES FOR METAL 3D PRINTING SUPPORT STRUCTURES FOR METAL 3D PRINTING

- Supports are generated by one-click operation using Materialise-defined defaults
- Supports associative to the part and controlled by the user either by:
 - Manipulating all parameters (delivered by Materialise)
 - Creo native functionality





Forward Looking Information is Subject to Change © 2018 PTC



FROM CREO R&D LAB – IN A FUTURE RELEASE

- Creo 5 Axis Hybrid Additive/subtractive
- Powered by Moduleworks
- Fully-integrated in PTC Creo
- Comprehensive material deposition/removal simulation

In partnership with:







🔋 🗋 🚰 い・ロ・講・習・ 🛙	7		N	/IFG0001 (Active) - Creo Para	metric Version P-50-48		– 윤 ×
File Manufacturing Model	Analysis Annotate	e Tools View /	Applications Mill	Turn			^ D 🖸 - 🔞
Copy Image: Pattern ▼ Image: Pattern ▼	Axis × Point ▼ → Coordinate System	Reference Model • •	Work Cutting Op Center Tools	Deration	Mill Volume Turn Profile Mill Surface Stock Boundary Mill Window Drill Group	Play Path T CL File T CL File	
Operate 👻 🛛 Edit 👻	Datum 🔻	Components 🔻	Machine Tool Setup 🔻	Process 🔻	Manufacturing Geometry 🔻	Validate - Output -	
🖁 - Model Tree 🤗 Folder Browser 💽 Favorites				17			
Model Tree					4 4 4 A 🛛 🔟 🛄 📾 🚈 🧯		
▼ × +							
MFG0001.ASM				(
□ NC_ASM_RIGHT							
C NC_ASM_TOP							
L/ NC_ASM_FRONT							
PRT0001.PRT							
▶ 🗇 PRT0002.PRT							
L ACS2							
W1.PRT							
L ACSO							
U OP010 [MILLTURN01]							
D ADTM1							
L ACS1							
1. Laser Deposit Sequence 1 [OP010]							
2. Face Milling 1 [OP010]							
Insert Here							
			1				





Take Action				Conclusion Conclusion
AM: Compelling reasons to act	Lightweight designs with lattices	Topology optimized designs	Additive Manufacturing in Metal	Wrap-Up

DESIGN FOR ADDITIVE MANUFACTURING CAPABILITIES Sptc WITH CREO

Description	Creo 3.0	Creo 4.0	Creo 5.0
Creo Parametric			
Direct Connect to Stratasys Plastic Printers (understand material usage and Print Times)	~	~	~
Create Print Trays		~	~
Print Check	~	~	~
Direct Connect to 3D System Plastic Printers (understand material usage and Print Times)		~	~
Direct Connect to i.materialize Print Bureau		~	~
Direct Connect to Plastic Printers in the Materialise Library (Manage print drivers and profiles)			~
Direct Connect to 3D Systems ODM Print Bureau			~
Creo Additive Manufacturing Extension			
Lattice Modeling		~	~
Modify, Manage and Save Print Tray Assemblies		~	~
Automatic Positioning and Nesting in Print Tray Assemblies		~	~
Global Interference Check		~	~
Creo Additive Manufacturing Plus Extension for Materialise			
Direct Connect to Metal Printers in the Materialise Library (Manage print drivers & profiles)			~
Generate and Customize Metal Support Structures			~
Creo Topology Optimization Extension			
Topology Optimization			~
Semi-Auto Geometry Conversion			V







CREO 6 – WHAT IS COMING? DESIGN FOR ADDITIVE MANUFACTURING•

OPTIMIZE



Strategy

DESIGN

VALIDATE

3DP

CHECK

creo

Connected Printers

• Support of 3D printer driver for MS Windows:

3D printing partners

We've provided a list of partners for the first wave of 3D printer apps and devices. Together, we can make end-to-end 3D manufacturing accessible to anyone using Windows 10.

Microsoft 3D Printing Explore. Docs and Samples Downloads Community Dashboard



- Printers and Bureaus:
 - Generic API to allow Service Bureaus and Printer Companies to connect to Creo



Printer coverage

DfAM Geometry

• Gyroid lattice cell type



 Conformal and Foam lattices



Downskin Analysis and positioning



Variable density



BOSTON CONVENTION & EXHIBITION CENTER June 10 – 13, 2019

REGISTER FOR YOUR ALL ACCESS PASS: FOR ONLY \$500! USE CODE: FORUM19

* Offer only valid until January 9th, 2019

THE WORLD'S MOST RESPECTED DIGITAL TRANSFORMATION CONFERENCE

7000+ Technologists

240+ Breakout Sessions

300+ Industry Experts

100+ Product Demos

liveworx.com #LIVEWORX

