

CREO SIMULATE ROADMAP

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AGENDA

1. Creo 5 Release
2. Pre-Processor
3. Engine
4. Post-Processor
5. Key proposed new extensions
6. Conclusions & Remarks

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1. **Creo 5 Release**

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WHAT IS IN CREO 5 FOR SIMULATE?

- Creo 5 will be a short release
 - Targeting FCS on next March
- We have been listening to you
 - We acknowledge the reported issues and its importance
- Focus on fixing the issues the user community have been raising
- Expansion to new capabilities using partners

Creo 5.0

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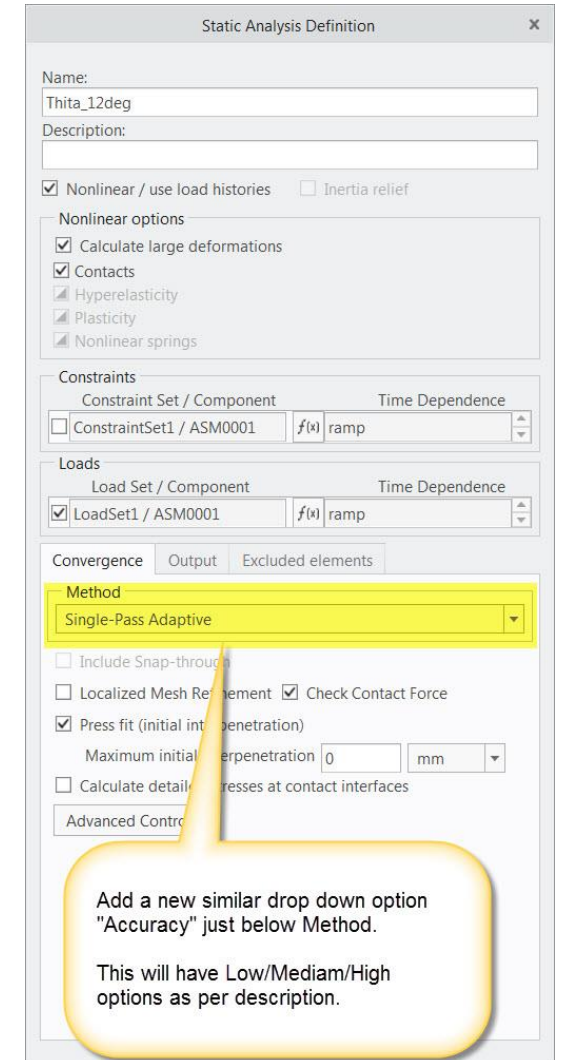
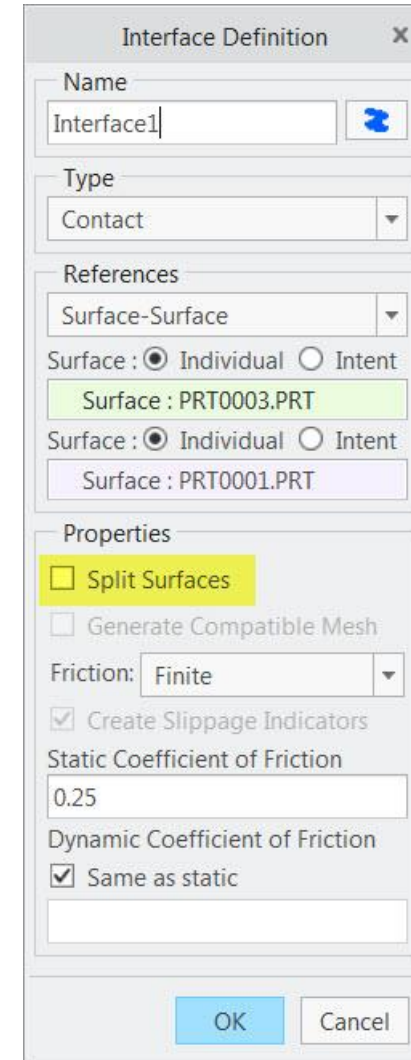
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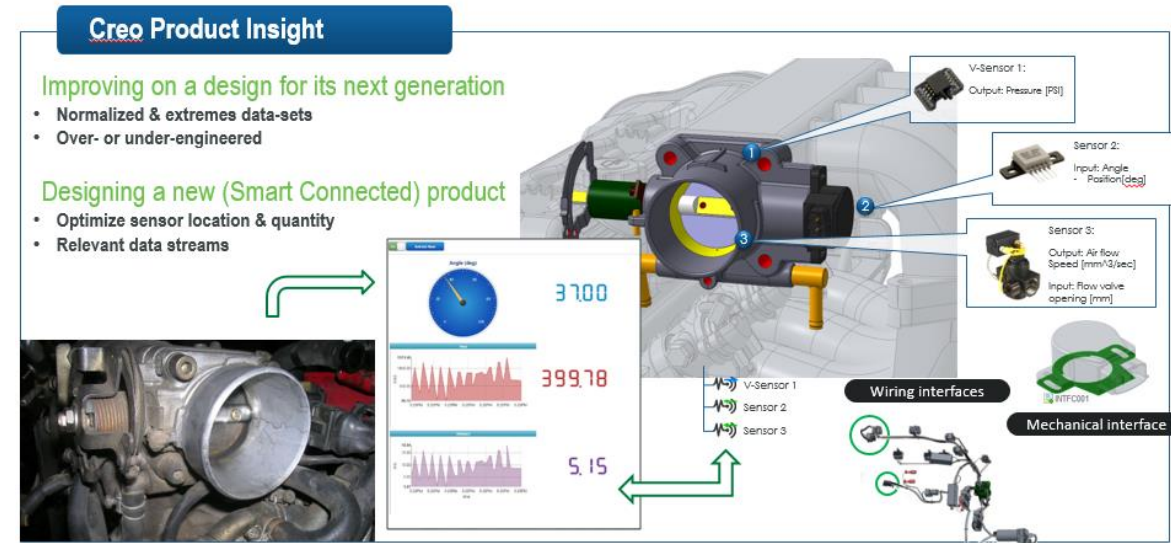
- Finite & Infinite Friction – support UI changes.
 1. Split surface checkbox deactivation:
 - For Finite Friction and None friction cases, we should deactivate split surfaces checkbox. Correction...
 2. Accuracy UI support:
 - For contact analysis types-SDA/LDA, we will support new drop down option on analysis dialog-box.
 - This drop down will allow user to choose between Low/Medium/High accuracy as appropriate.
 - For SDA contact analysis type, this will have choice of only Medium (Default) and High.
 - For LDA contact analysis type, this will have choice of all Low (Default)/Medium/High.

– Note: For all other linear analysis types, this should gray out with accuracy set to High.

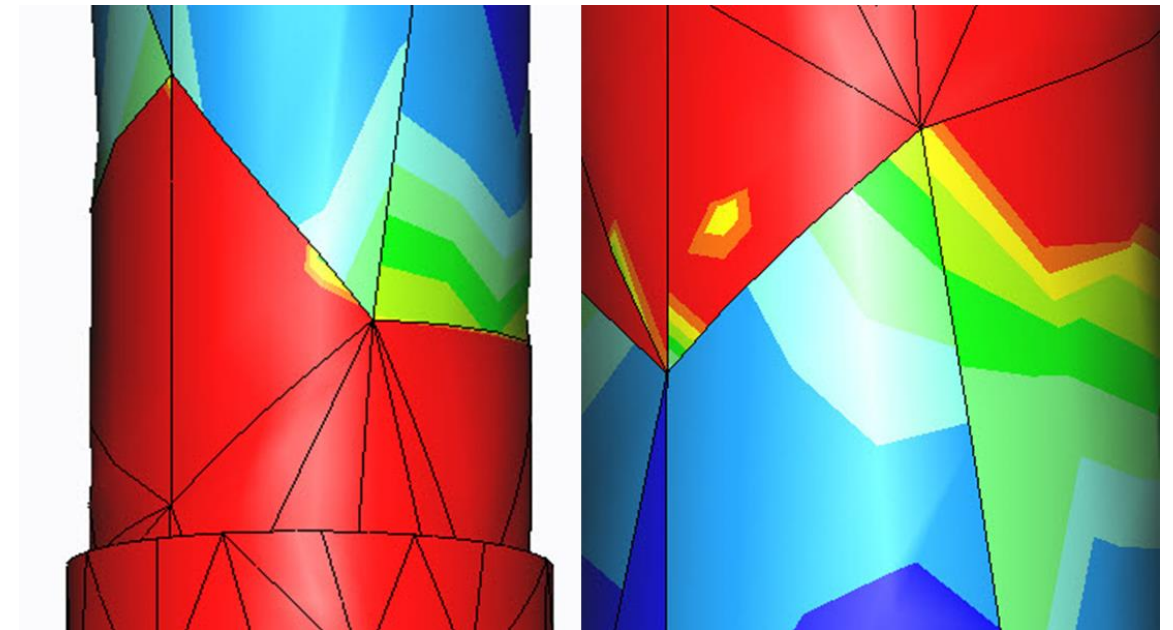
- 3. UI will pass this info to as appropriate to engine via new engine commands:
 - LOW accuracy engine cmd: -contact_full_looser
 - MEDIUM accuracy engine cmd: -contact_partial_looser
 - HIGH accuracy engine cmd: -contact_suspend_looser



- Ansys/Nastran updates.
- Currently we support Ansys version 14.5 and Nastran version 2012.
- Objective:
 - Update Ansys Version to Ansys18.0
 - Update Nastran version 2017
- Creo Insight – Virtual sensor support
 - Creo Simulate will be able to use real historical data gathered from sensors, directly into the simulation.
 - How products are performing in the field, optimize the choice, location and quantity of sensors in their product and validate they are collecting the correct data streams before production



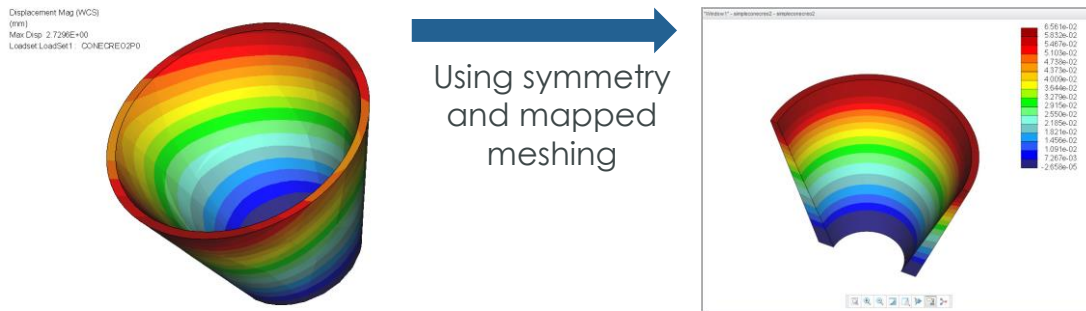
- Refine shell elements automatically if ratio of the thickness to the radius of curvature is too large.
 - In some use cases, stress results were not smooth across the adjacent element edges and nodes have different stresses from different elements (elements belonging to the same surface). See the below pictures with averaging turned off.
- Solution:
 - Affected region has to be identified and internally set the optimized “Maximum Element Size Control”. So good quality elements can be created in right size and ratio.



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- Accurate results for revolve cone
 - With the out of the box settings, without the need of adjustments.

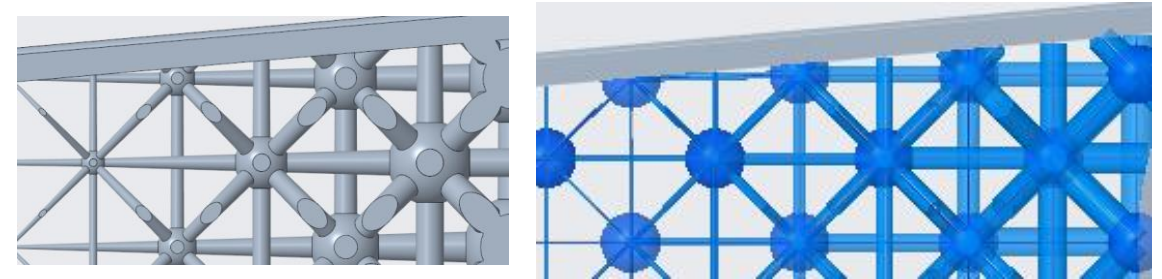


<https://www.ptcusercommunity.com/thread/59938>

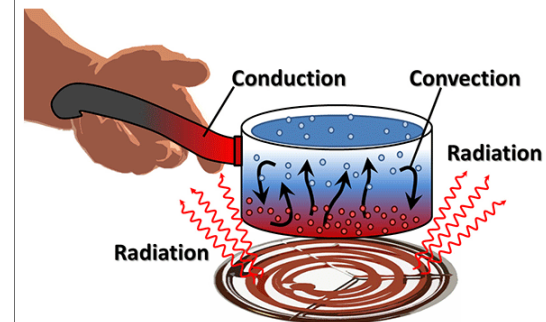
- Use NAFEMS Verification models for:
 - Code Verification – the mathematical model and solution algorithms are working correctly
 - Calculation Verification - the discrete solution of the mathematical model is accurate.
 - Plasticity – 4, Finite Friction – 7, Frictionless contact – 1, LDA Contact – 1, LDA – 2, Dynamic Analysis – 5.



- Support the tapered beams in simulate for *simplified lattice*



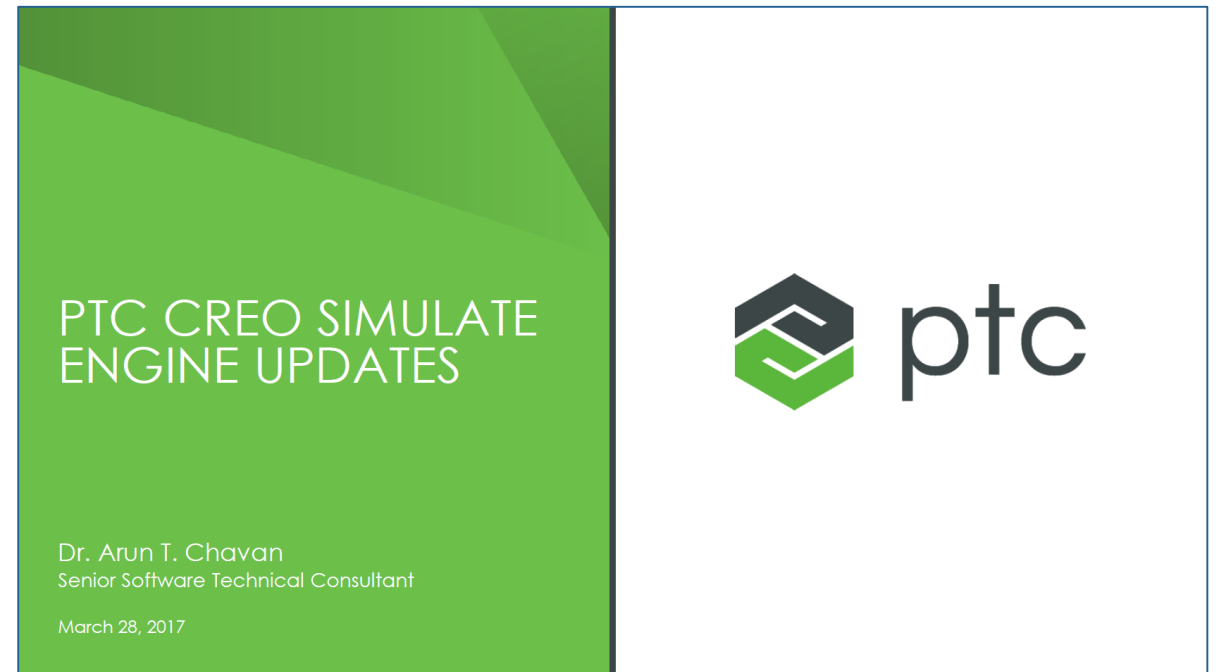
- Ability to apply a convection and radiation condition to the *same reference*



The image above, provided by NASA, highlights how all three heat-transfer methods (conduction, convection, and radiation) work in the same environment.

- Interface max penetration
 - New user defined measure to export maximum penetration seen by engine for given interface.
- Interface contact spring stiffness
 - New user defined measure to export the contact spring stiffness for given interface.
- Promote sim_contact_penetration config option to Interface dialog
 - It will allow users to input contact penetration for every interface.
 - It will provide additional flexibility to tune their model.
 - Useful in models that have wider range of contacts between different materials.
- Promote Calculate detailed stresses at interfaces to Interface dialog from analysis dialog
 - It will help users to selectively choose the key interfaces on which they want detailed stress output.

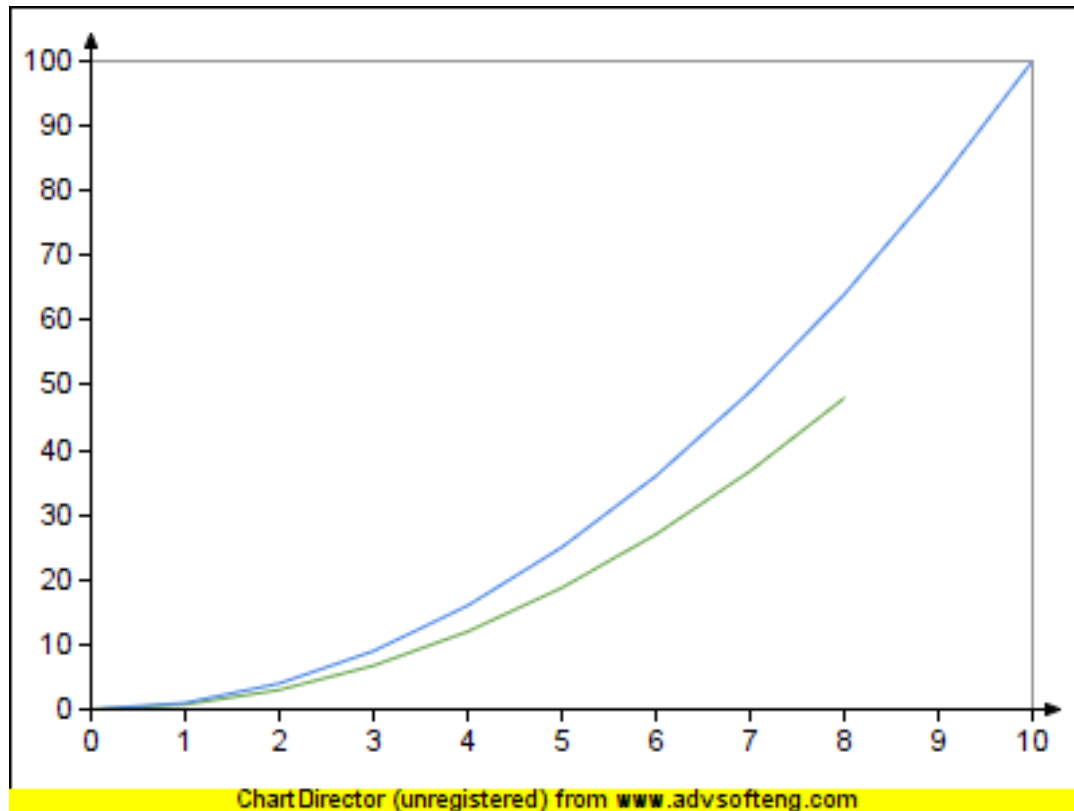
- This enhancements will be detailed in the presentation about Creo Simulate Engine Updates



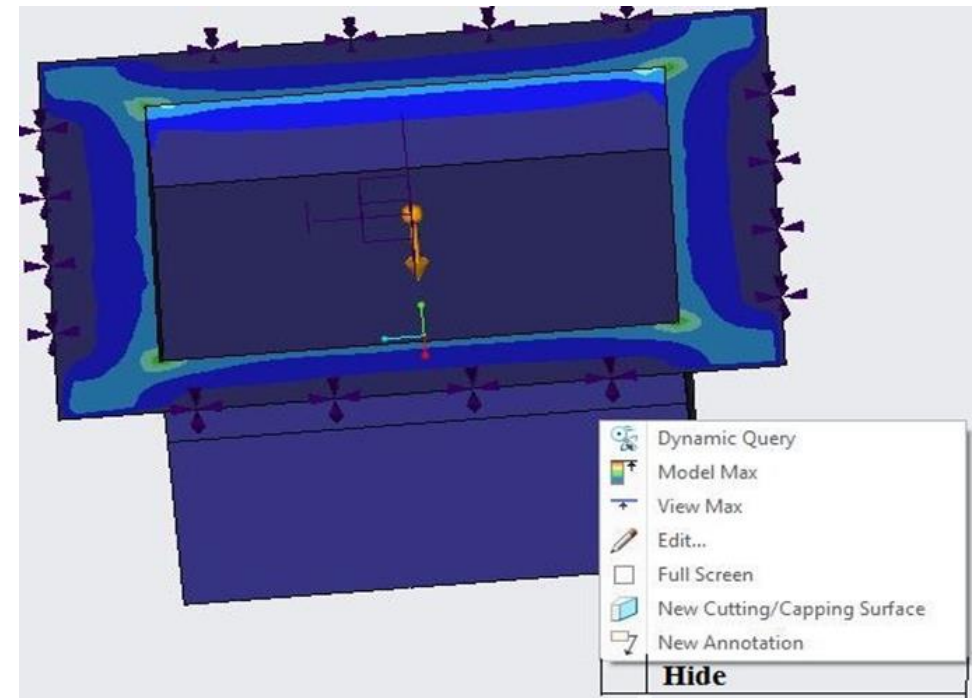
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- Graphing capabilities for Simulate
 - Integrating ChartDirector a Graphing app for graphing instead of existing old-looking BMX graphs.



- Enhance component selection in results
 - Right click (RMB) on the Component you want to Hide from the Model shown in Result Window and an option for Hiding the selected component will be provided in Existing RMB options as shown in picture below.



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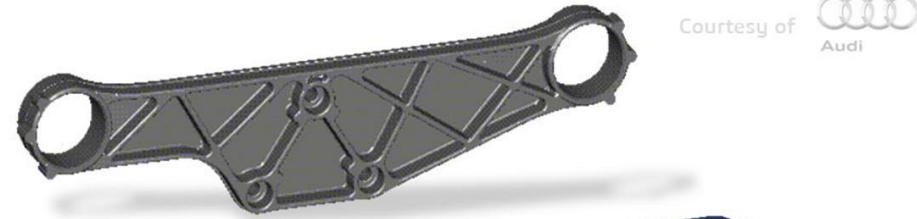
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TOPOLOGY OPTIMIZATION

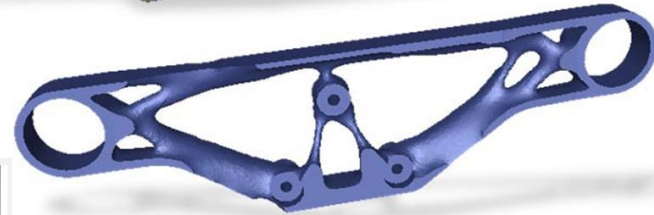
Industry news



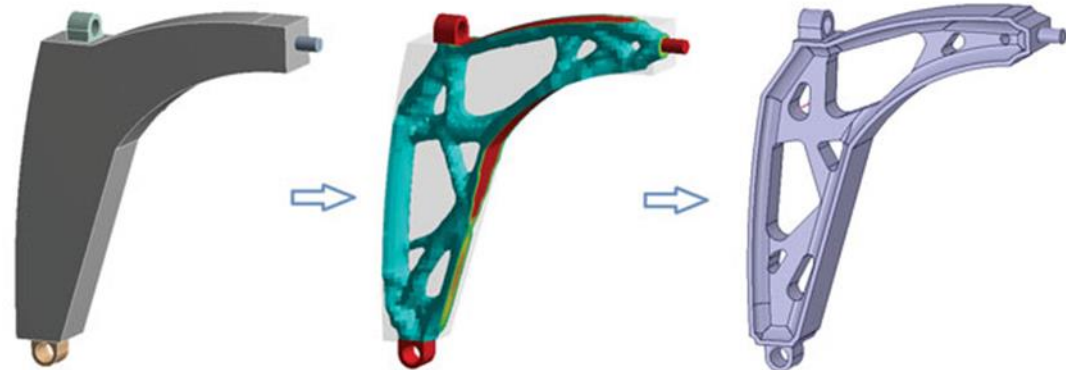
Renault Trucks: Metal Additive Manufacturing could reduce engine weight by 25%



Courtesy of Audi



Dassault Systemes: Tosca Topology Optimization



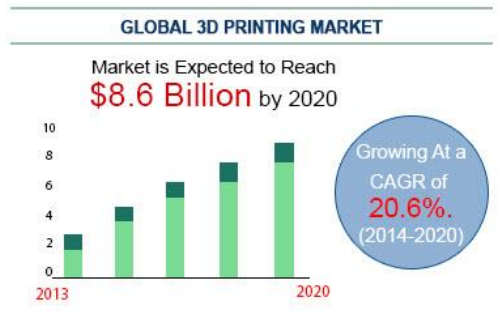
GENESIS Topology for ANSYS Mechanical (GTAM) from Vanderplaats Research & Development.

ASSESSING THE OPPORTUNITY

- Multiple analysts reach the conclusion that 3D printing will revolutionize the Manufacturing Industry

- What are the main drivers to adopt this technology?

GLOBAL 3D PRINTING MARKET Size & Forecast, (2013-2020)



GLOBAL 3D PRINTING MARKET BY TECHNOLOGY

• Stereolithography	• Selective Laser Sintering
• Electron Beam Melting	• Fused Deposition Modeling
• Laminated Object Manufacturing	• Others



GLOBAL 3D PRINTING MARKET BY APPLICATION

Consumer Products	Industrial Products
Defense	Aerospace
Healthcare	Automotive
Education and Research	Others

GLOBAL 3D PRINTING MARKET BY MATERIAL

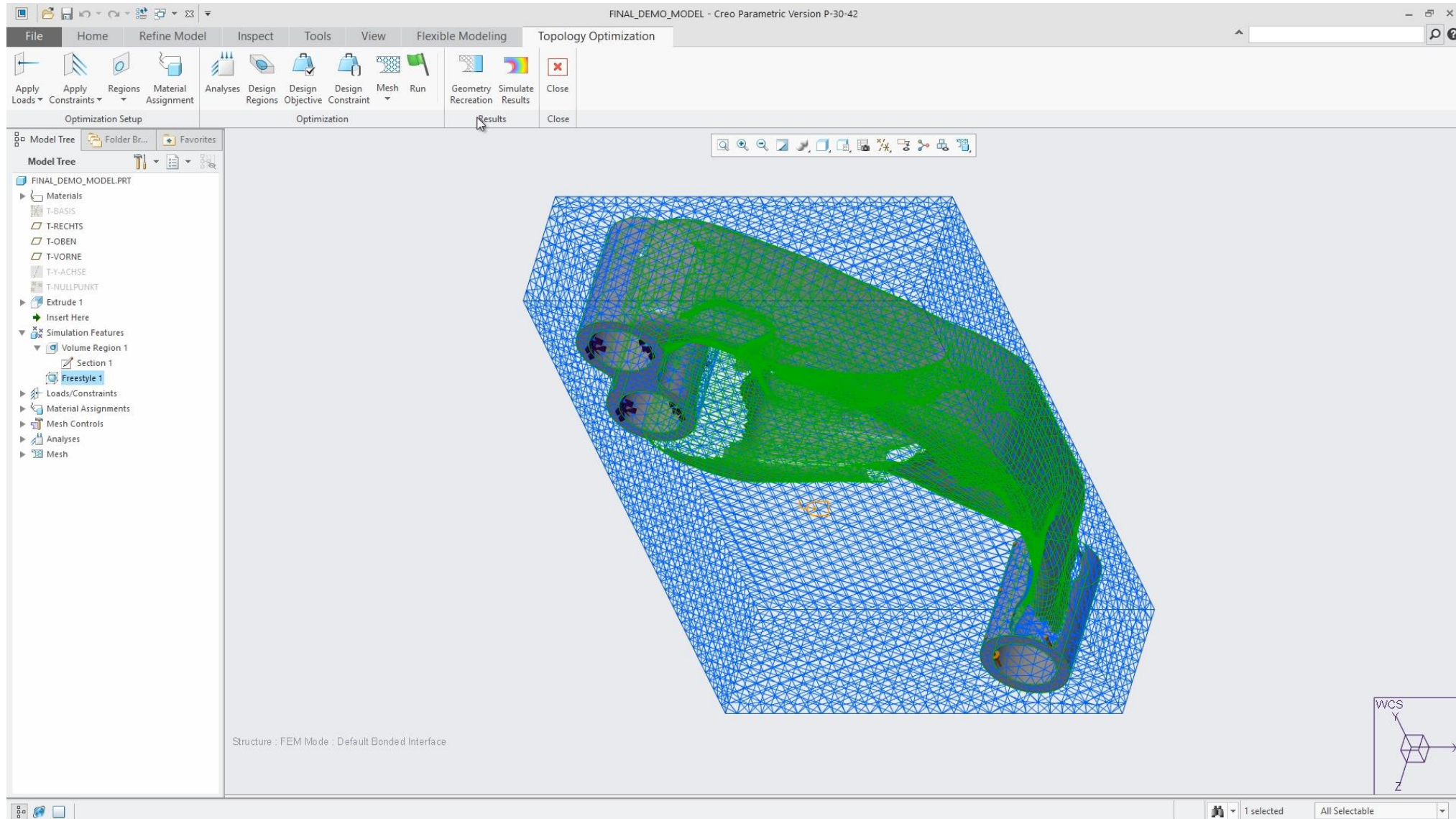
Polymers	Metals
Ceramics	Others

- GLOBAL 3D PRINTING MARKET DYNAMICS**
- Drivers**
- Efficient use of material
 - Use of multiple materials for printing
 - Reduction in human error
 - Customization of products
 - More competitive advantages
 - Delivering various innovation opportunities
 - Reduces development cost and time
 - Efficient logistic management
- Restraints**
- Higher cost for individual user
 - Software required for 3D printing are costly
 - Lack of channel partner assistance
 - Lack of skilled labor
 - Size of output generated

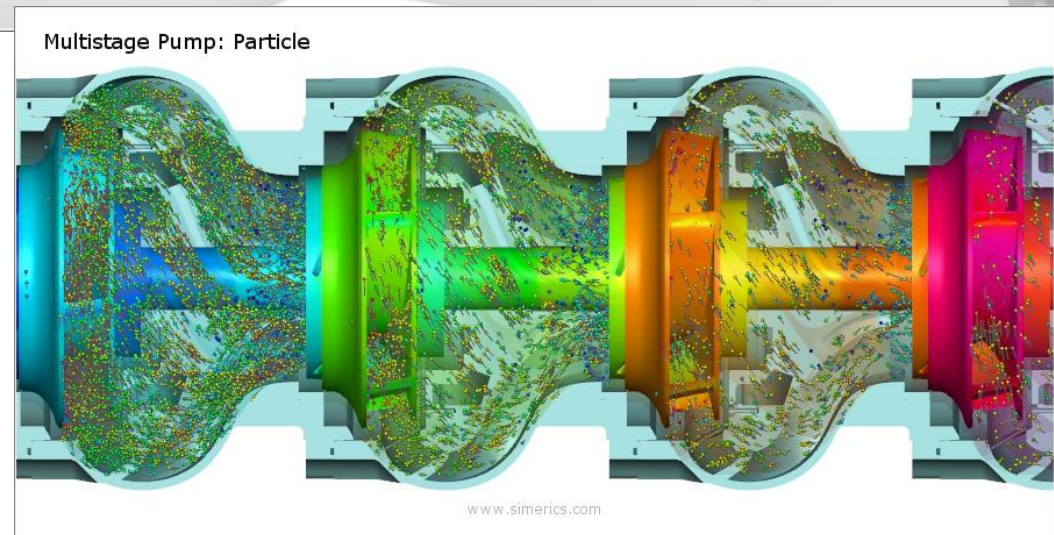
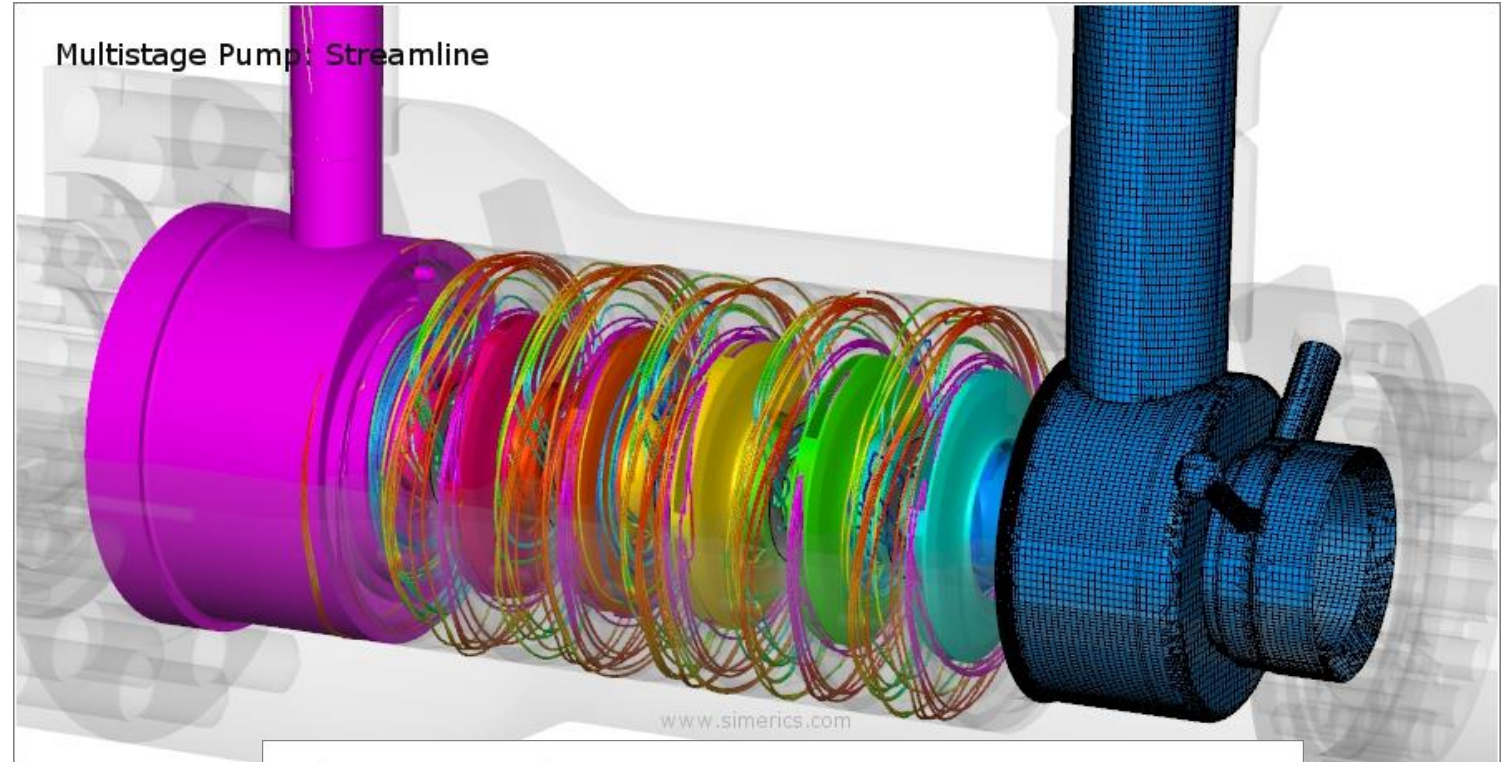


<http://www.forbes.com/sites/louiscl Columbus/2015/03/31/2015-roundup-of-3d-printing-market-forecasts-and-estimates/#57f234881dc6>

WORKFLOW – PROTOTYPE/PROOF OF CONCEPT (VIDEO)

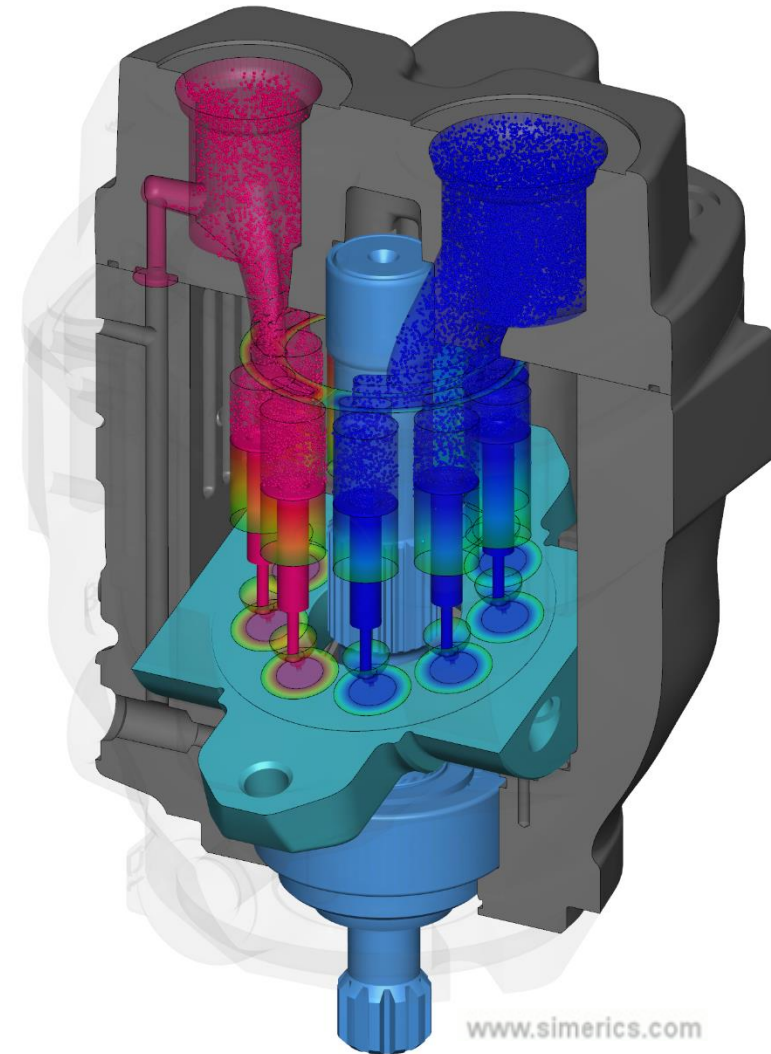


COMPUTATIONAL FLUID DYNAMICS - CFD



ASSESSING THE OPPORTUNITY

- CFD Market Expanding for two major reasons, among many others:
 - Fluids Volume Modeling (solid model negative) expands CFD simulation to broader market and more design studies and cases.
 - Parametric CAD is well suited for Fluids Volume Modeling and the key to CFD workflows. Fluids Volume Models require parameters and optimization.



Creo 5 scope

- **Creo CFD:**

- Fully embedded in Creo.
- Ability to calculate Internal and External Flows.
- Animate internal or external Flow results in real time.
- Flow, Heat Transfer, Turbulence.
- Parallel Processing Simulation.

- **Creo CFD Engineer**

- Fully embedded in Creo.
- Ability to calculate Internal and External Flows.
- Animate internal or external Flow results in real time.
- Flow, Heat Transfer, Turbulence, **Particle, Radiation, Species, Dynamics and Multicomponent Simulation. Moving/Sliding Meshing to Simulate Movement of Solids.**
- **Parallel Processing Simulation.**

- **Creo CFD Specialist:**

- Fully embedded in Creo.
- Ability to calculate Internal and External Flows.
- Animate internal or external Flow results in real time.
- Flow, Heat Transfer, Turbulence, Particle, Radiation, Species, Dynamics and Multicomponent Simulation.
- Moving/Sliding Meshing to Simulate Movement of Solids.
- Parallel Processing Simulation.
- **Plus Cavitation and Multiphase Simulation.**

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- Creo Simulate will have additional capabilities by integrating 3rd party applications
 - Topology Optimization
 - Computational Fluid Dynamic
 - Others in the future...
- We will continue fixing and improving the current capabilities
 - Focus on Friction, then other areas according to a prioritized list
- We will focus on workflow improvements for the SMB market



ptc