

## AI AND SIMULATION-DRIVEN DESIGN FOR ADVANCED MANUFACTURING

Simon Zwingert, Senior Technical Consultant – ALTAIR



**Our vision is to leverage computational science to drive intelligent decisions and innovation for a more connected, safe, and sustainable future.**



## Altair-at-a-Glance

**\$572M**

FY22 Revenue

**74 offices**

In 27 Countries

**3,000+**

Engineers, Scientists,  
and Creative Thinkers

**150+**

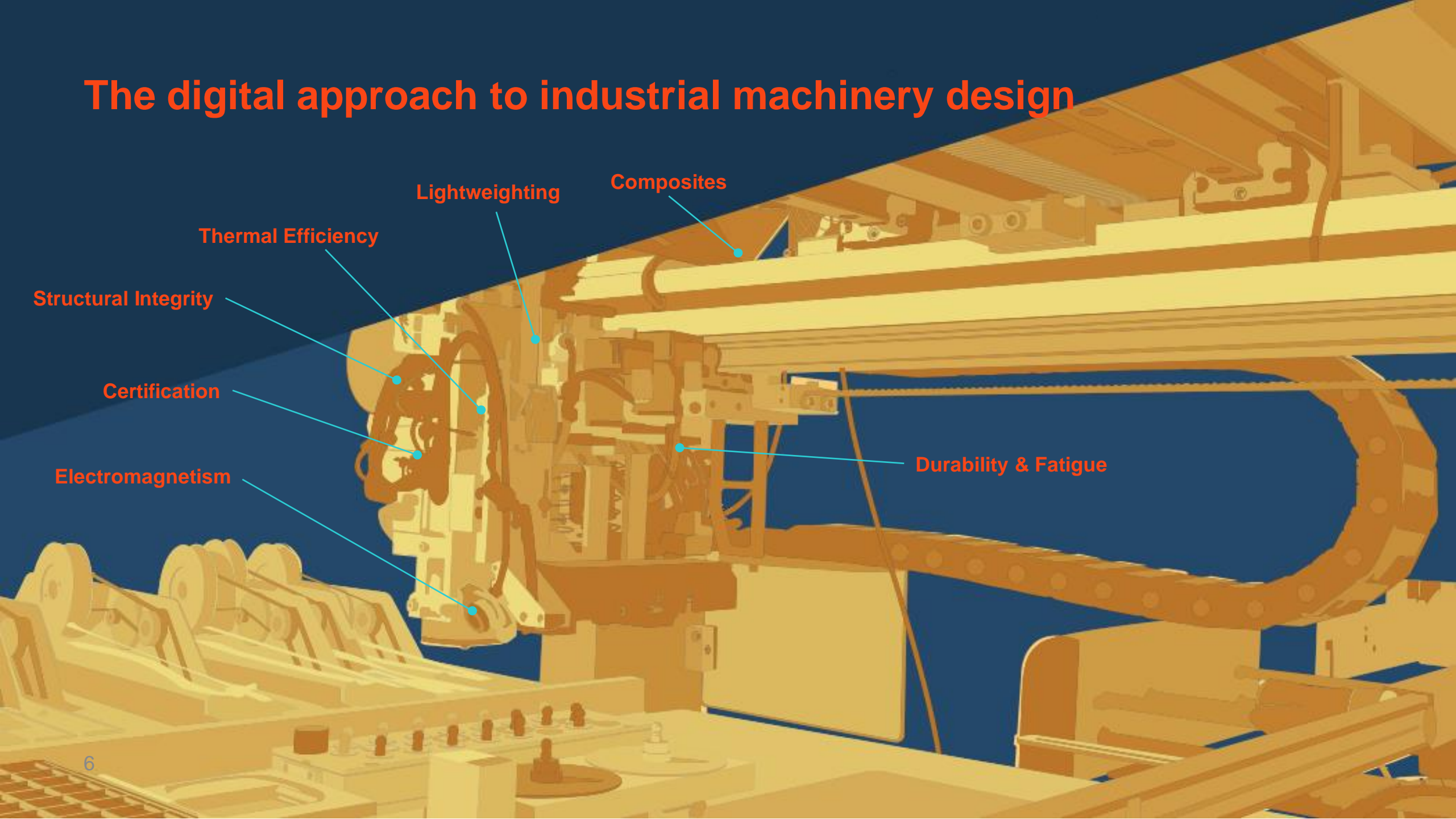
Altair and Partner  
Software Products

**13,000+**

Customers Globally

**EVERY PRODUCT STARTS WITH AN IDEA...**

# The digital approach to industrial machinery design



Lightweighting

Composites

Thermal Efficiency

Structural Integrity

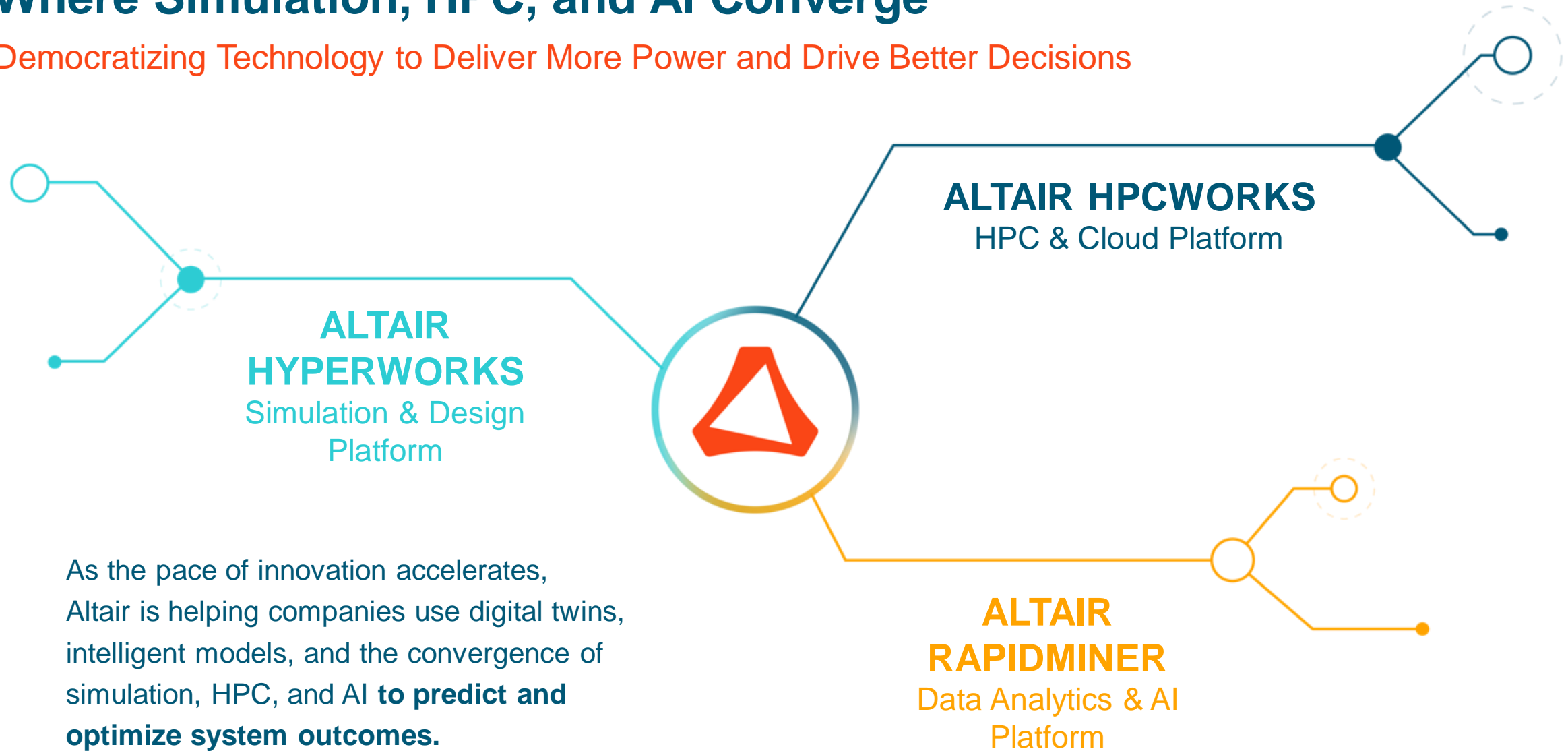
Certification

Electromagnetism

Durability & Fatigue

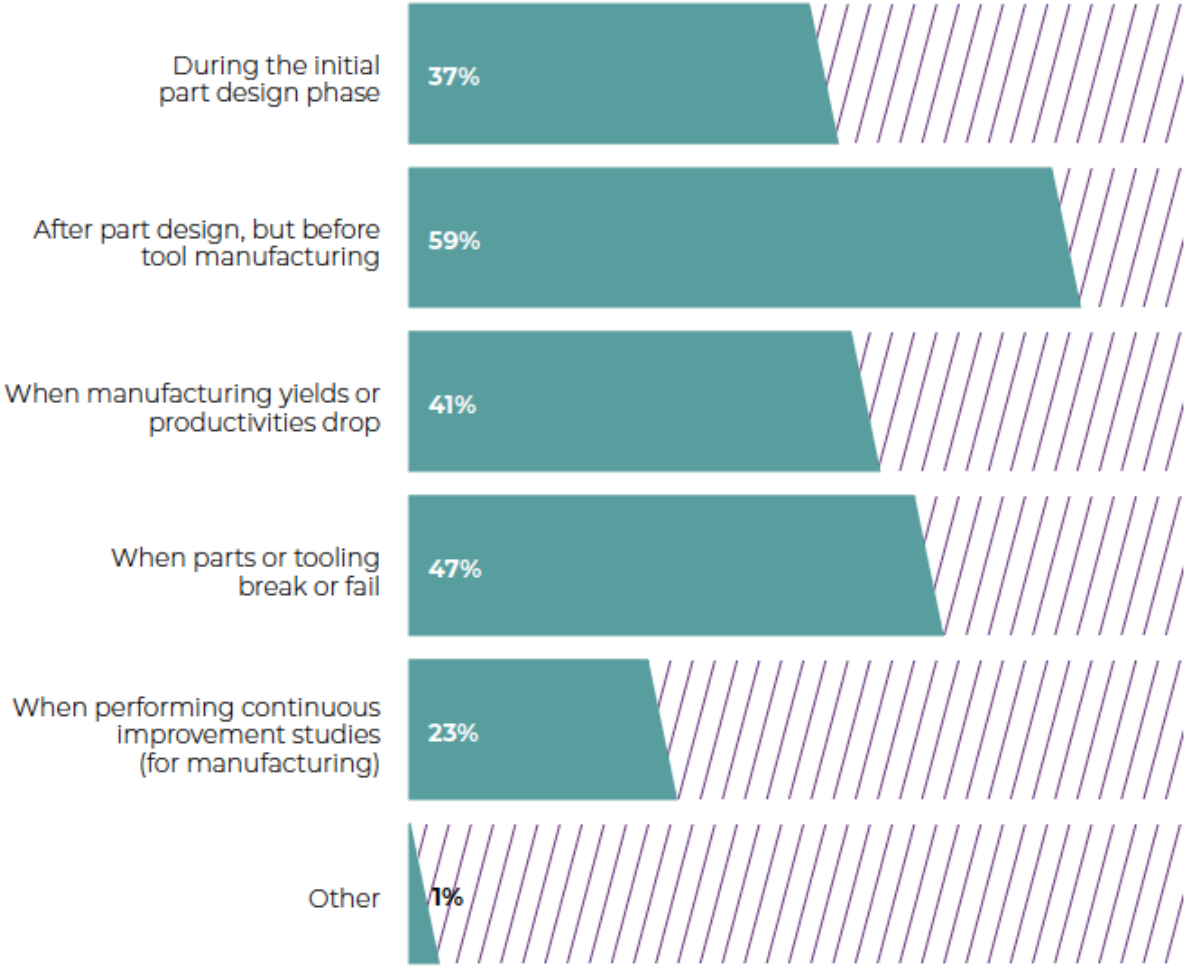
# Where Simulation, HPC, and AI Converge

Democratizing Technology to Deliver More Power and Drive Better Decisions



As the pace of innovation accelerates, Altair is helping companies use digital twins, intelligent models, and the convergence of simulation, HPC, and AI **to predict and optimize system outcomes.**

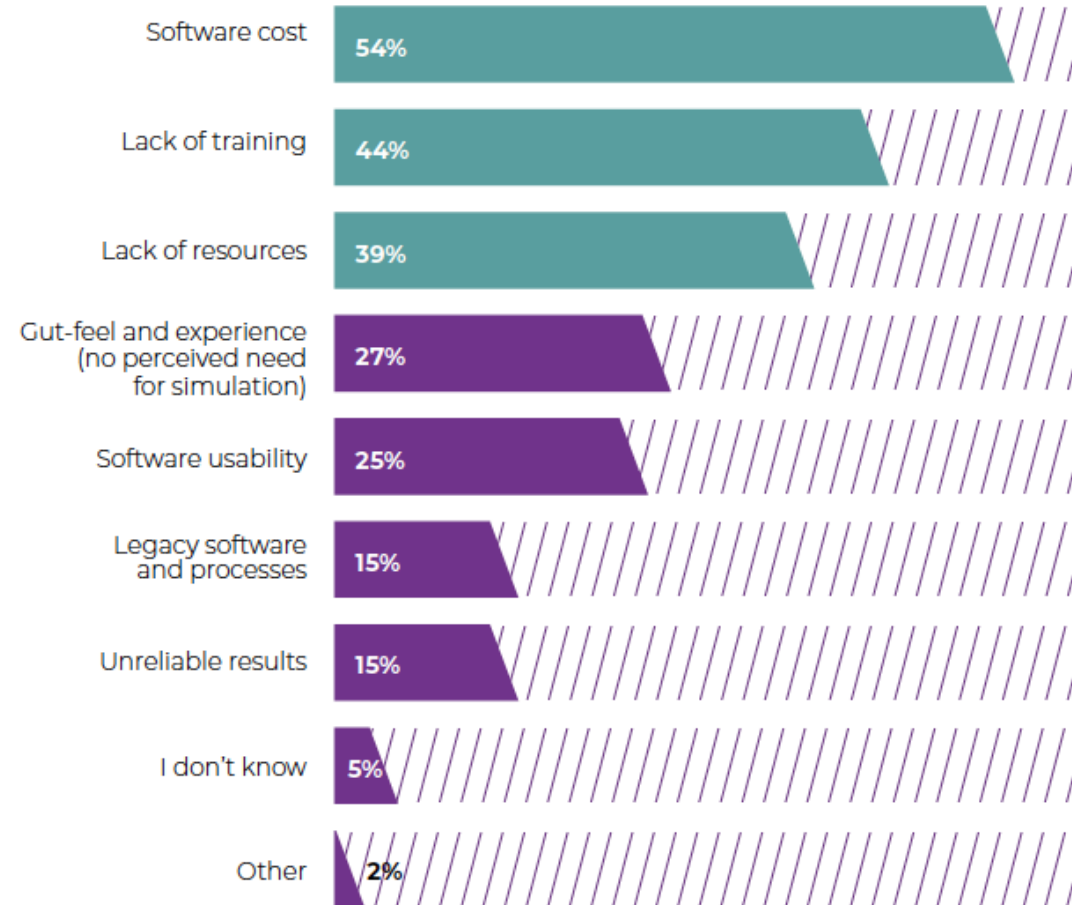
# When Do Engineers Apply Manufacturing Simulation?<sup>1</sup>



1:  **engineering.com** Research Report on Simulation-Driven Design for Manufacturing, sponsored by Altair



# What's Keeping Organizations from Adopting Simulation?



## Certification Program AM Design

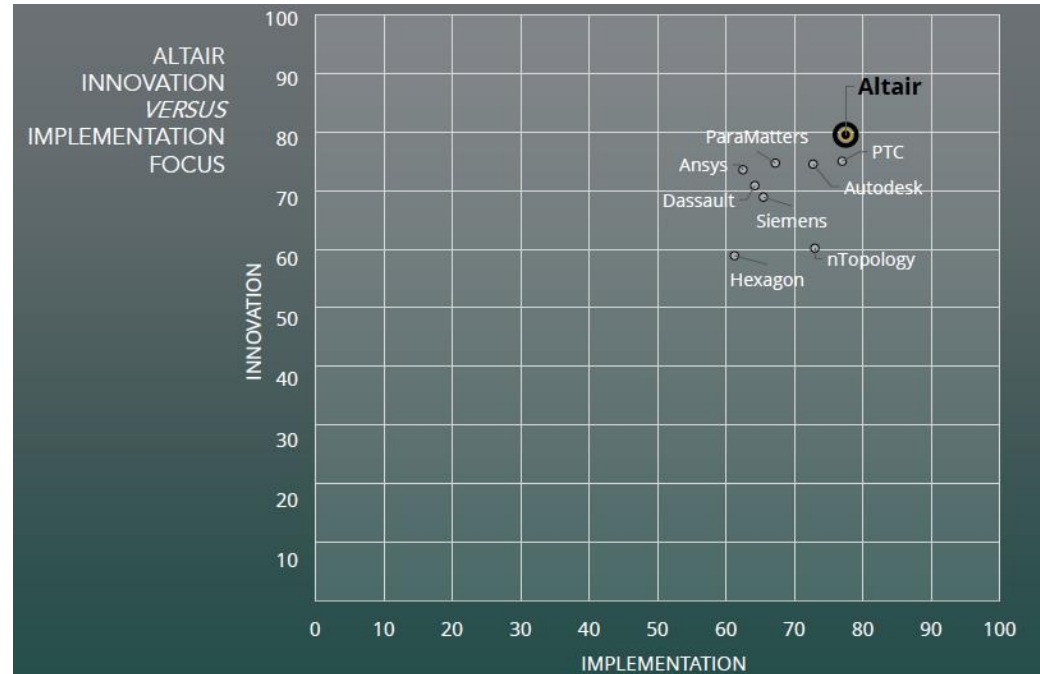
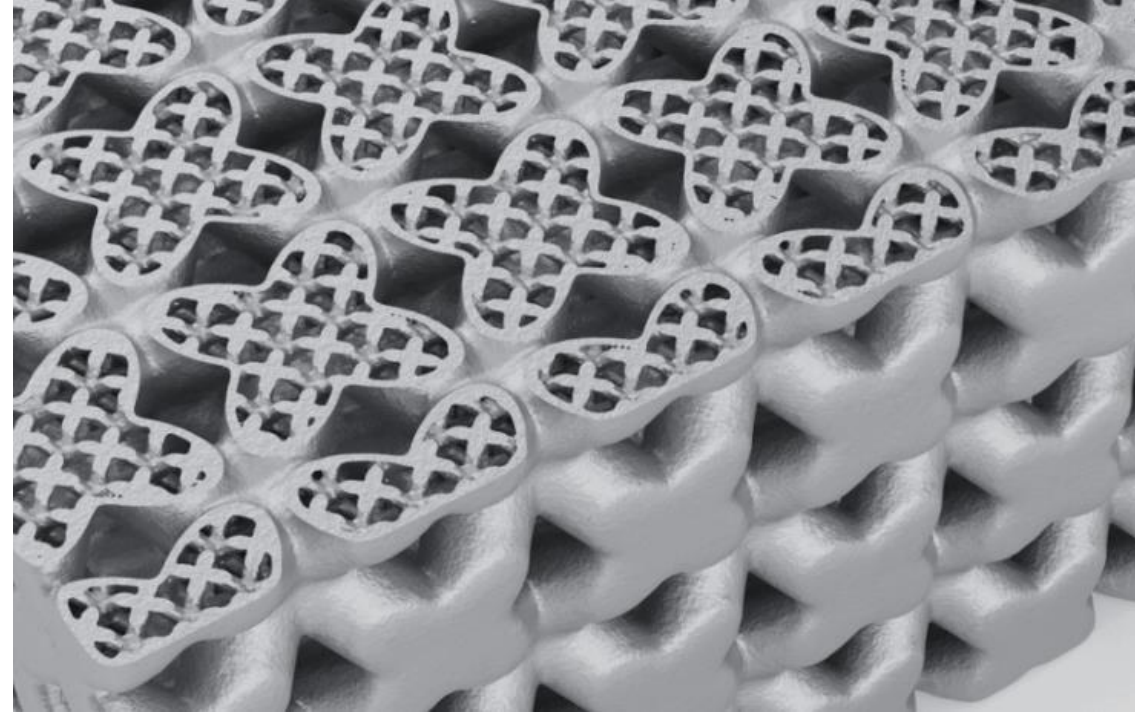


**CLICK TO ADD PRESENTATION TITLE**

CLICK TO ADD OPTIONAL PRESENTATION SUBTITLE

# A Recognized Leader

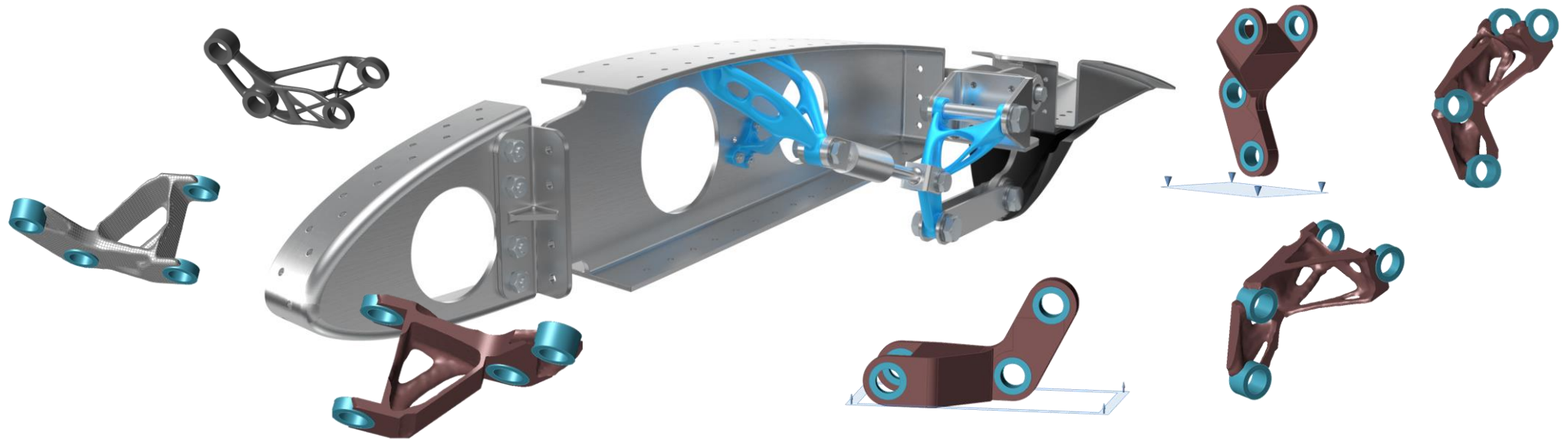
Altair was recently ranked by ABI Research as the overall leader, top innovator, and top implementer for **generative design**.



# Altair Generative Design is ...

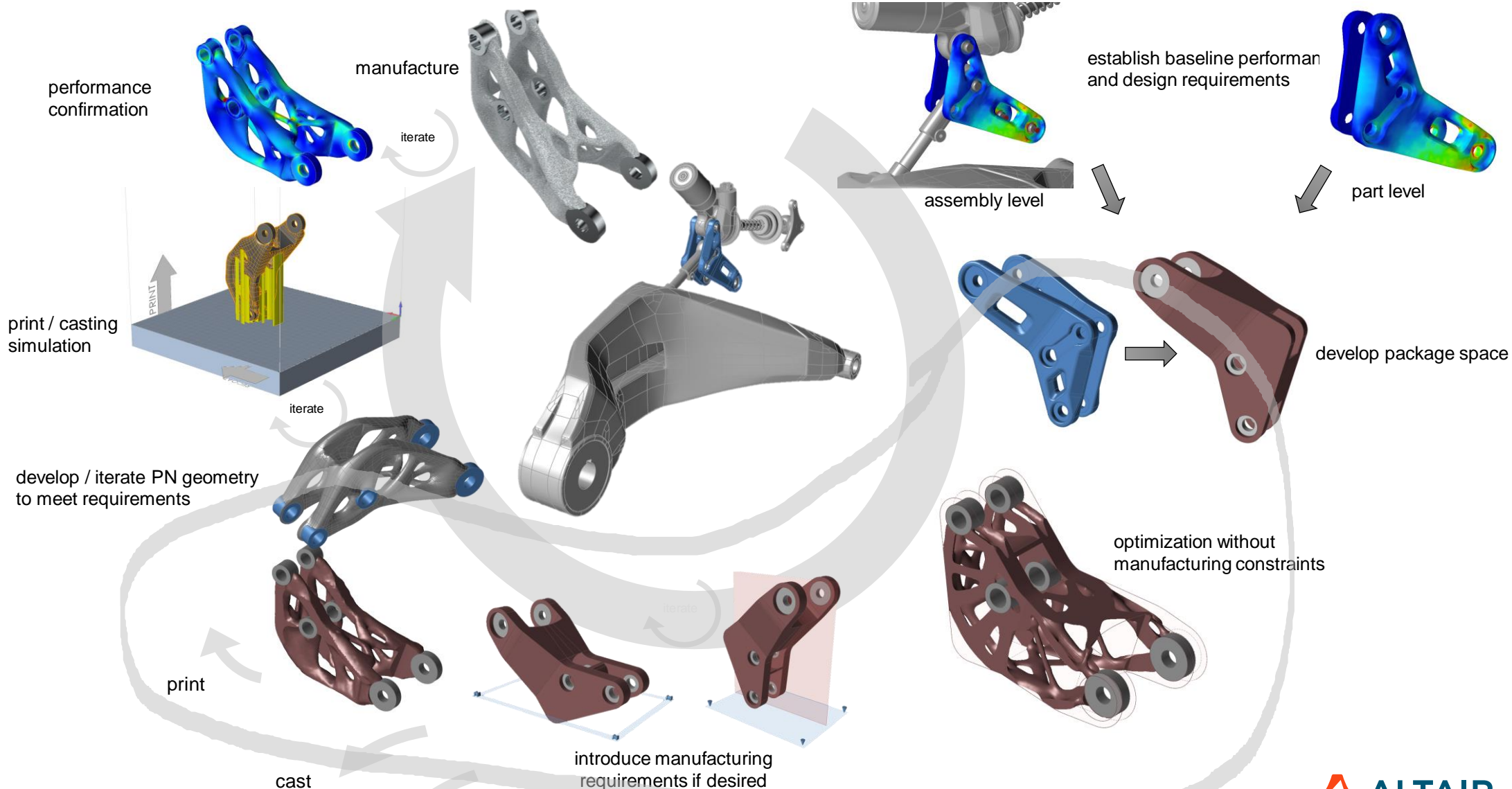
A computerized co-pilot in the design journey

**Design Exploration by generating and investigating multiple design alternatives** - typically but not always based on topology optimisation



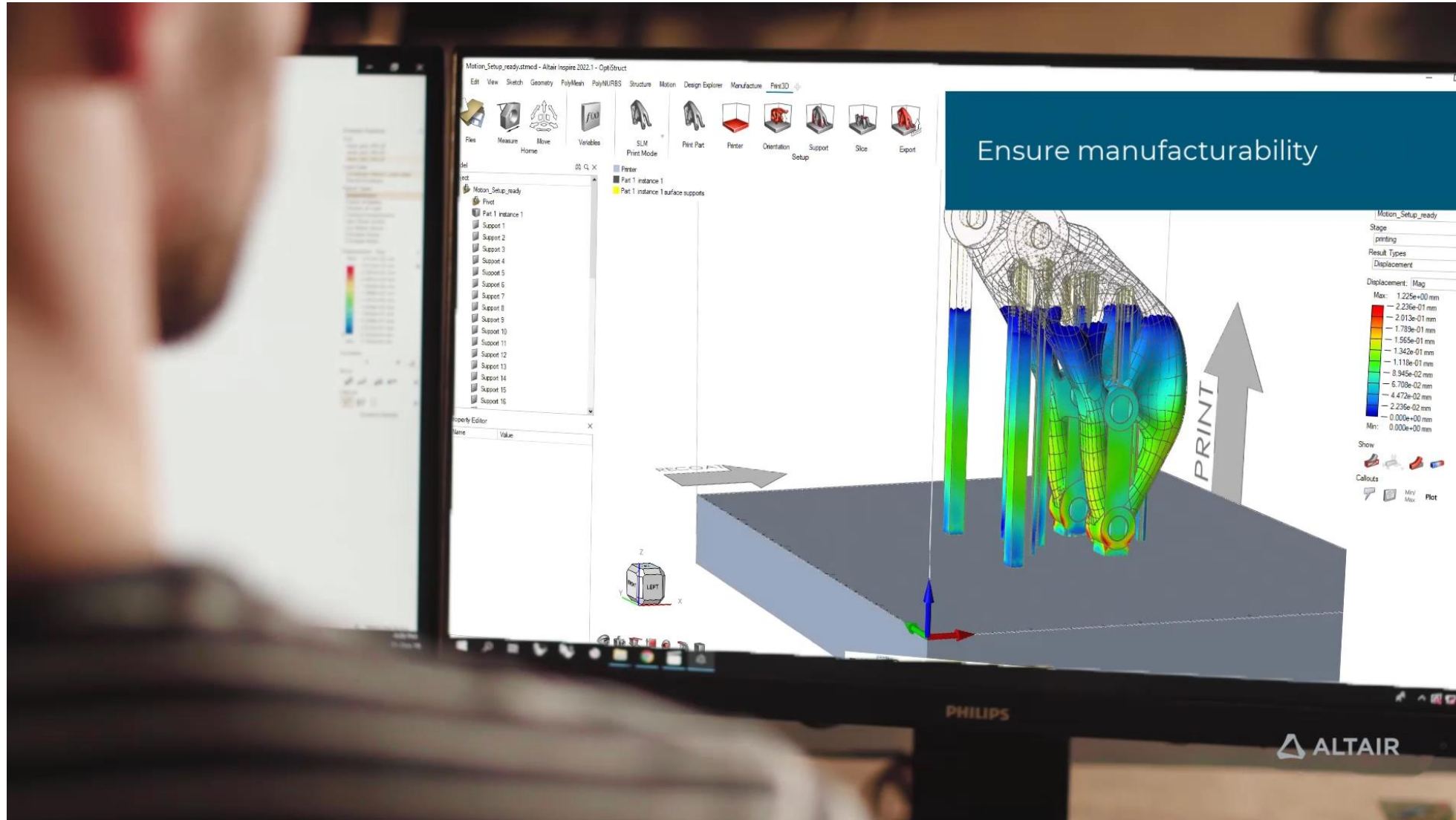
“Generative design is a set of technologies that provide computational intelligence to augment the design process, helping users engage the power of simulation, AI and HPC to develop validated and manufacturing-ready designs.”

# Simulation Driven Design Process



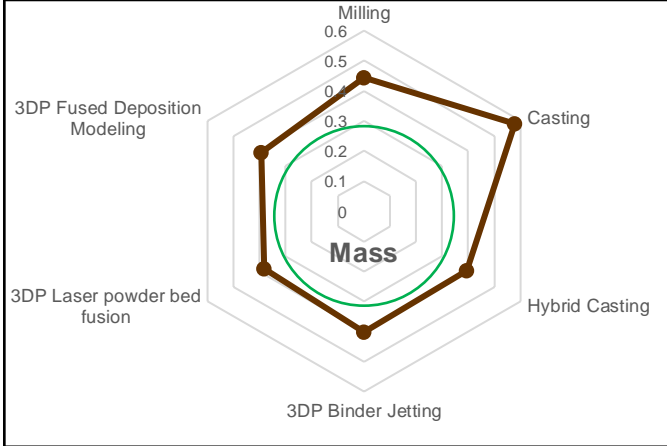
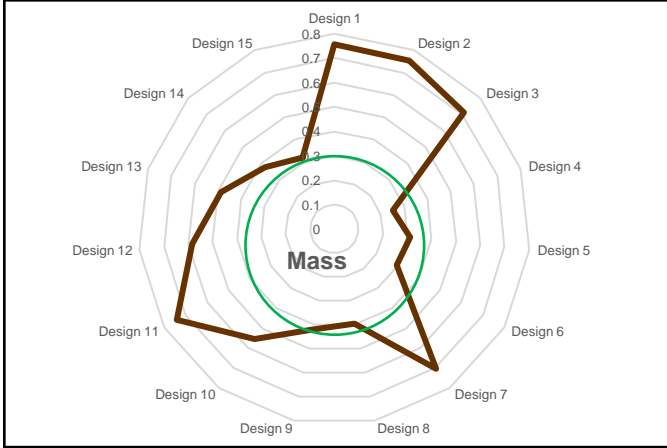
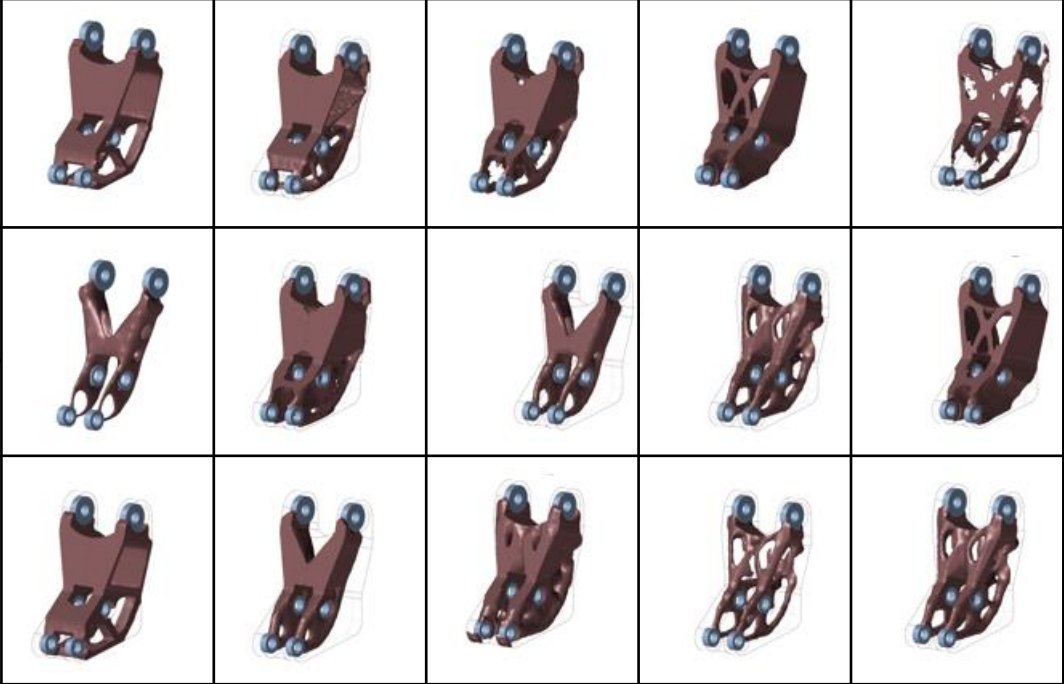
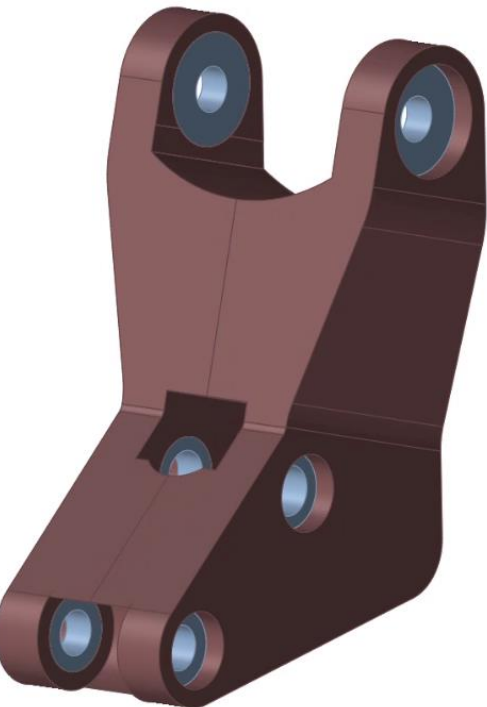
# Simulation Driven Design

## Optimization setup



# Design Exploration - generate design alternatives

Same Design Space, Different Requirements



Bracket Design Space

Bracket Design Options with Mass & Stress Parameters

# GENERATIVE DESIGN WITH MANUFACTURING IN FOCUS

What is the best manufacturing method for your project?

Milling



Casting



Hybrid Casting



Laser Powder Bed



Bound Metal Deposition



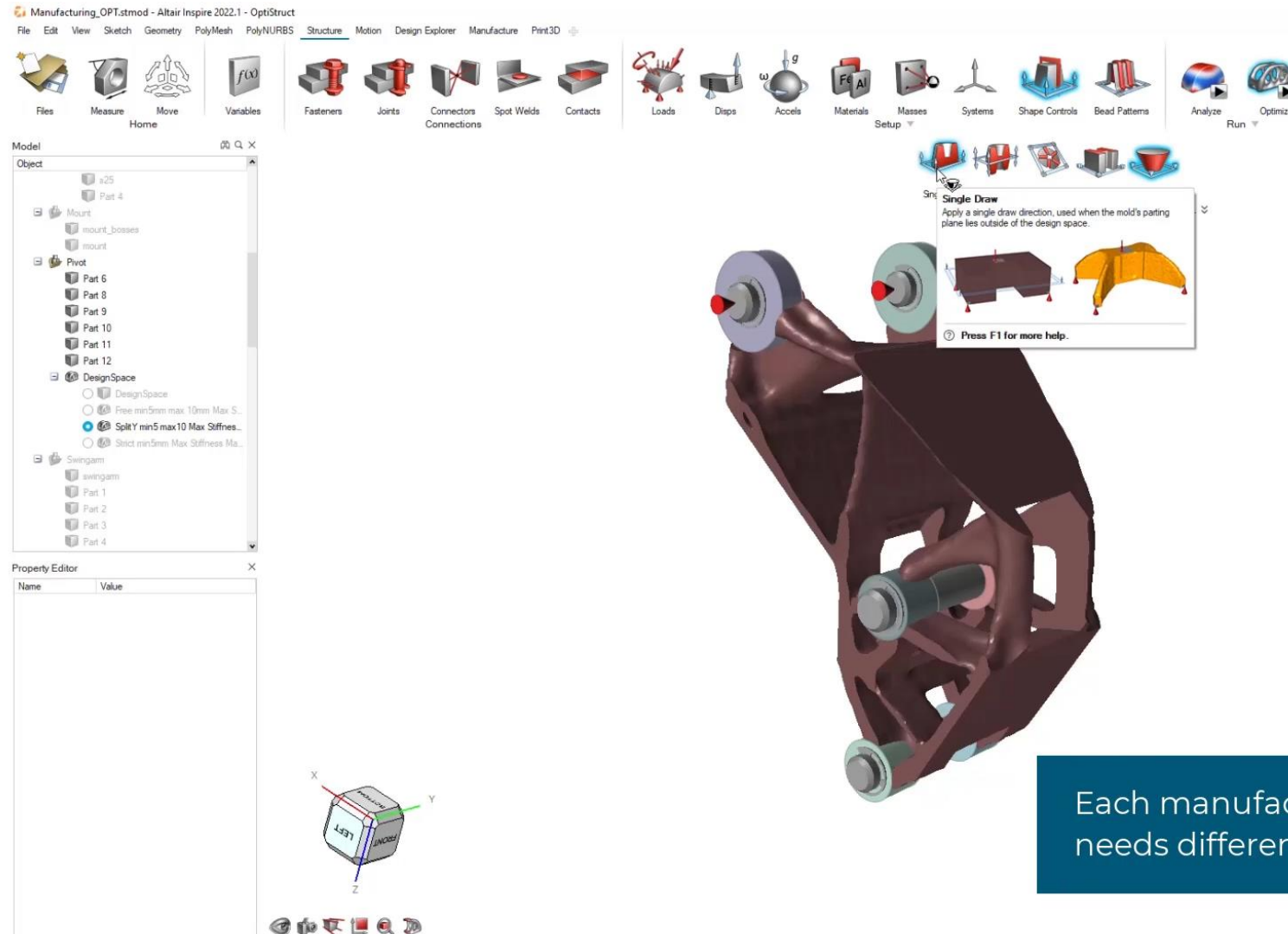
Fused Deposition Modeling





# Simulation Driven Design

## Optimization setup

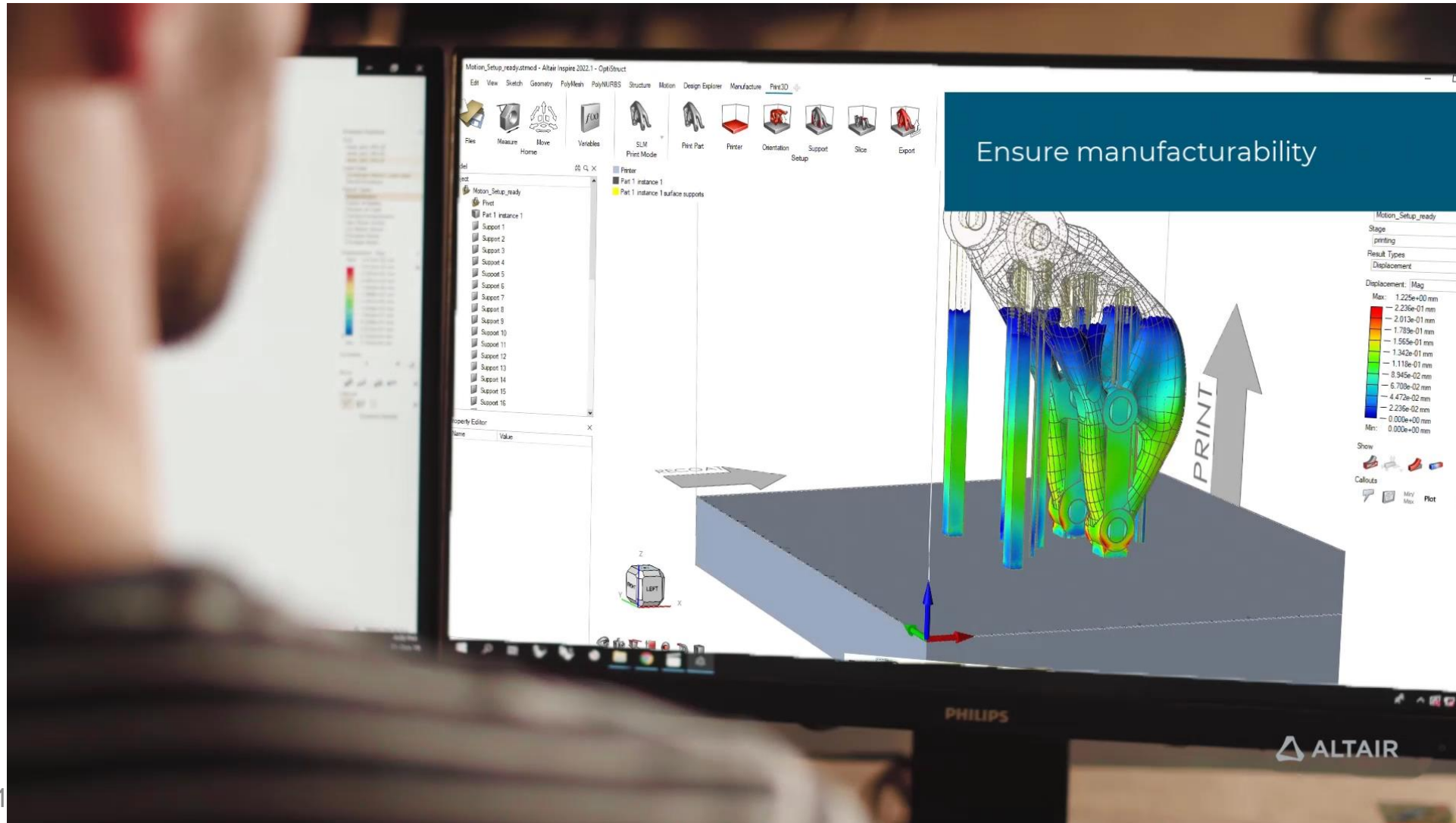


Each manufacturing process  
needs different shape controls

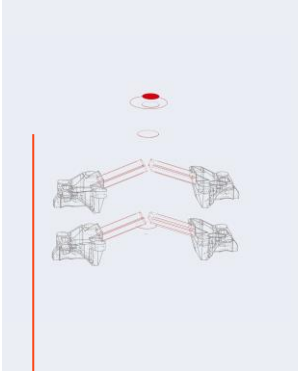


# Simulation Driven Design

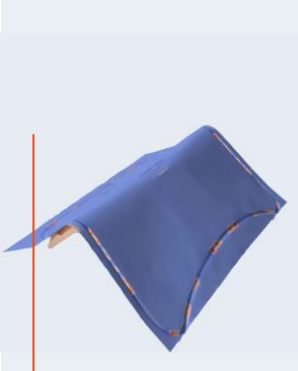
## Optimization setup



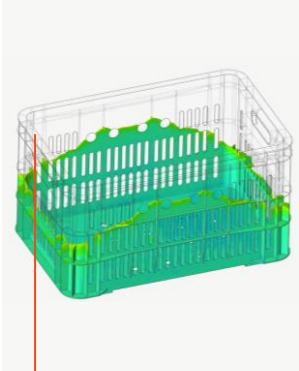
# Simulation-Driven Design for Advanced Manufacturing



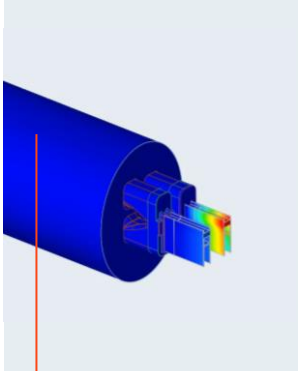
Casting



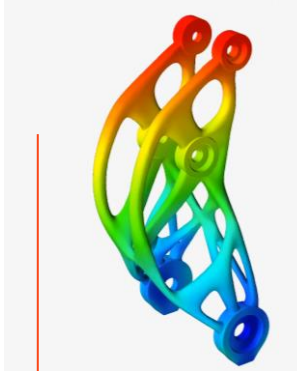
Metal Forming



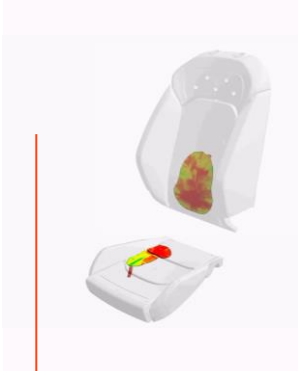
Injection Molding



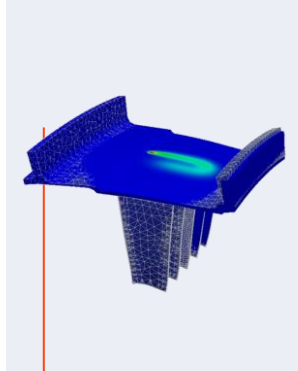
Extrusion (Metal and Polymer)



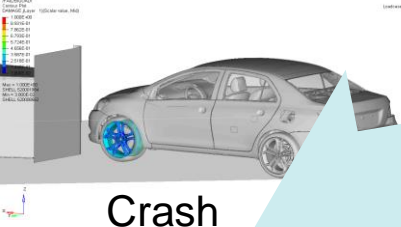
Additive Manufacturing



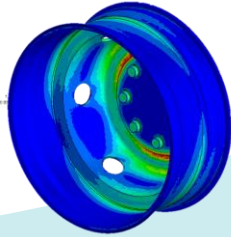
Polyurethane Foaming



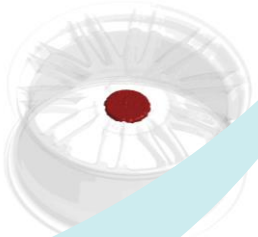
Welding



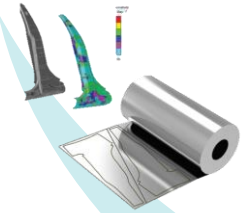
Crash



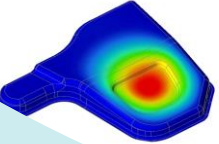
Static



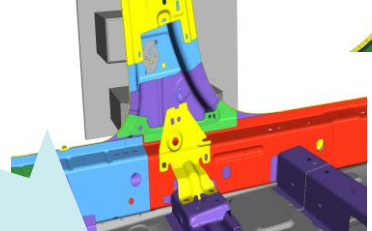
Casting



Forming



Static

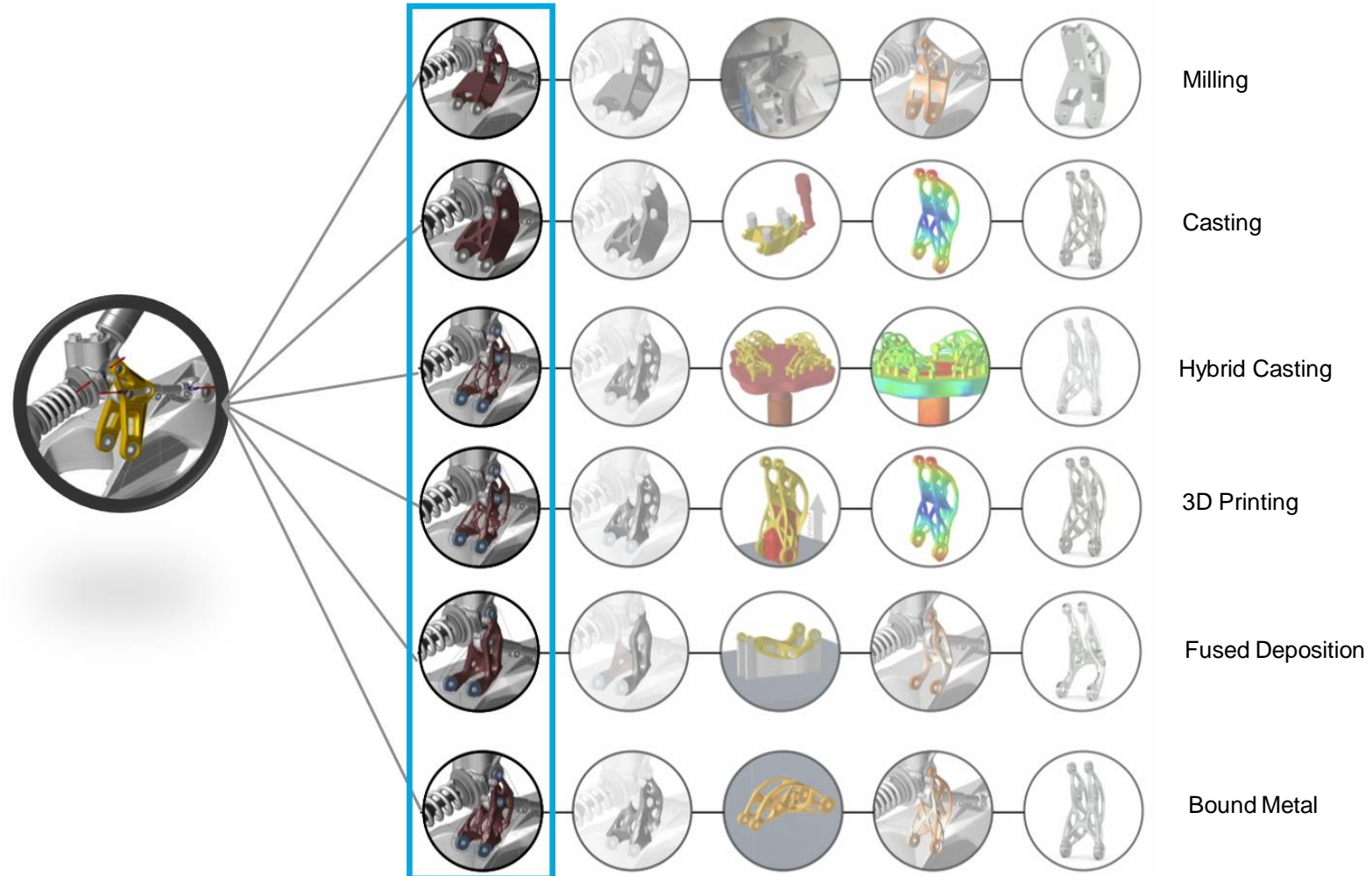


Dynamic

# Simulation-Driven Design for Advanced Manufacturing

## Summary

- Identification of requirements
- Generative design respecting manufacturing design rules
- Automatic creation of geometry
- Assuring part performance
- Manufacturing feasibility checked



# WHAT ABOUT AI?

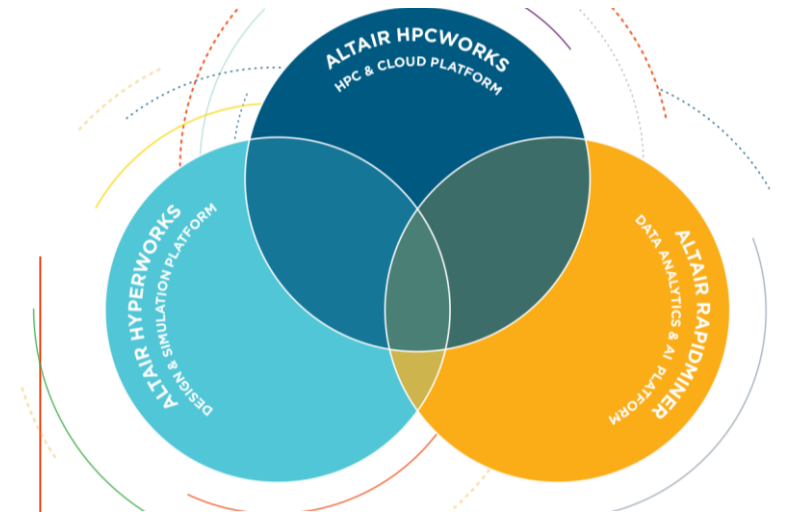
# AI-Powered Virtual Product Development



**Generative Design  
(Challenge) of  
EV Mega-Casting**



**Machine Learning for CAE –  
Frictionless  
→ AI Powered Virtual  
Manufacturing**



**Why Convergence of  
Simulation & Design,  
HPC & Cloud,  
and Data Analytics & AI  
matters in manufacturing.**

# WHAT ABOUT AI IN MANUFACTURING?





# AI Powered Virtual Manufacturing

Learn to predict physical behavior from simulation results – faster than simulation

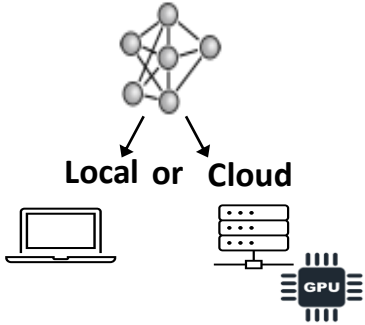
Historical data



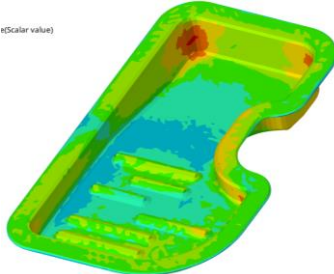
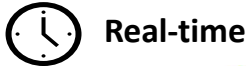
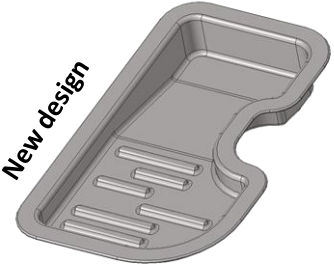
Historical Dataset:  
6 simulations varying  
each bead radius



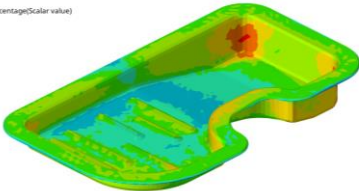
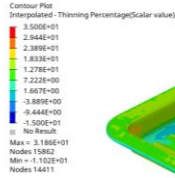
Train physicsAI



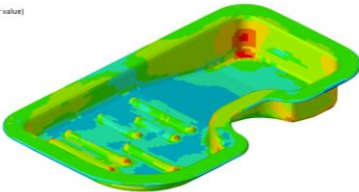
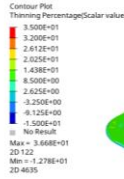
Real-time exploration  
also on CAD



Validate with solver



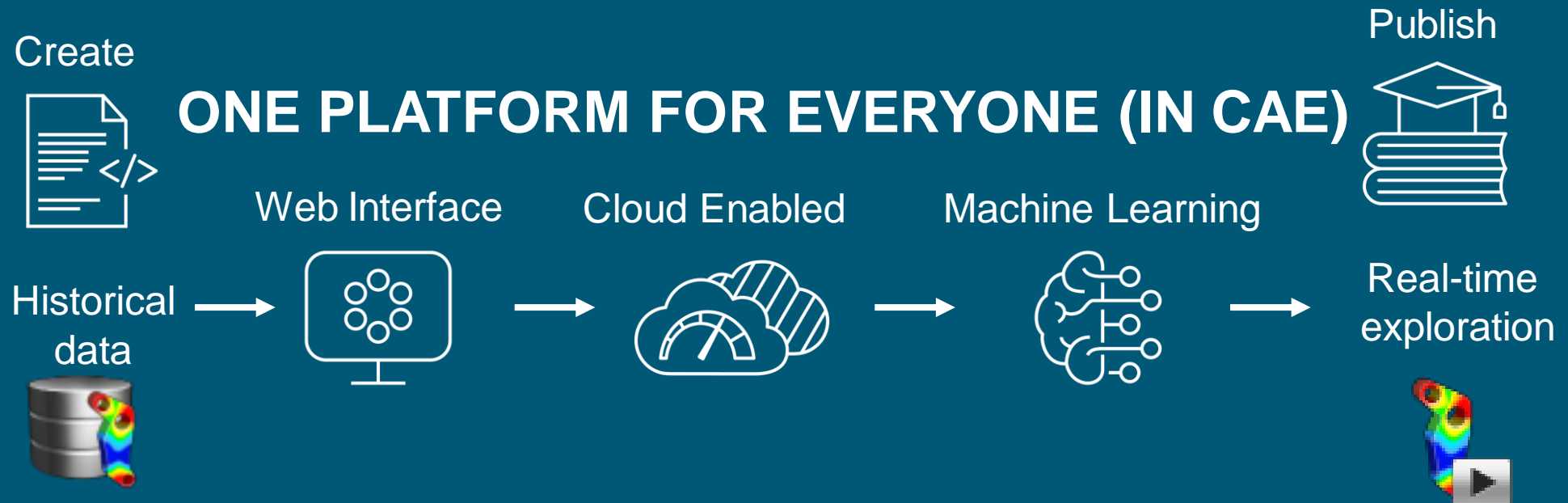
ML Model



Solver

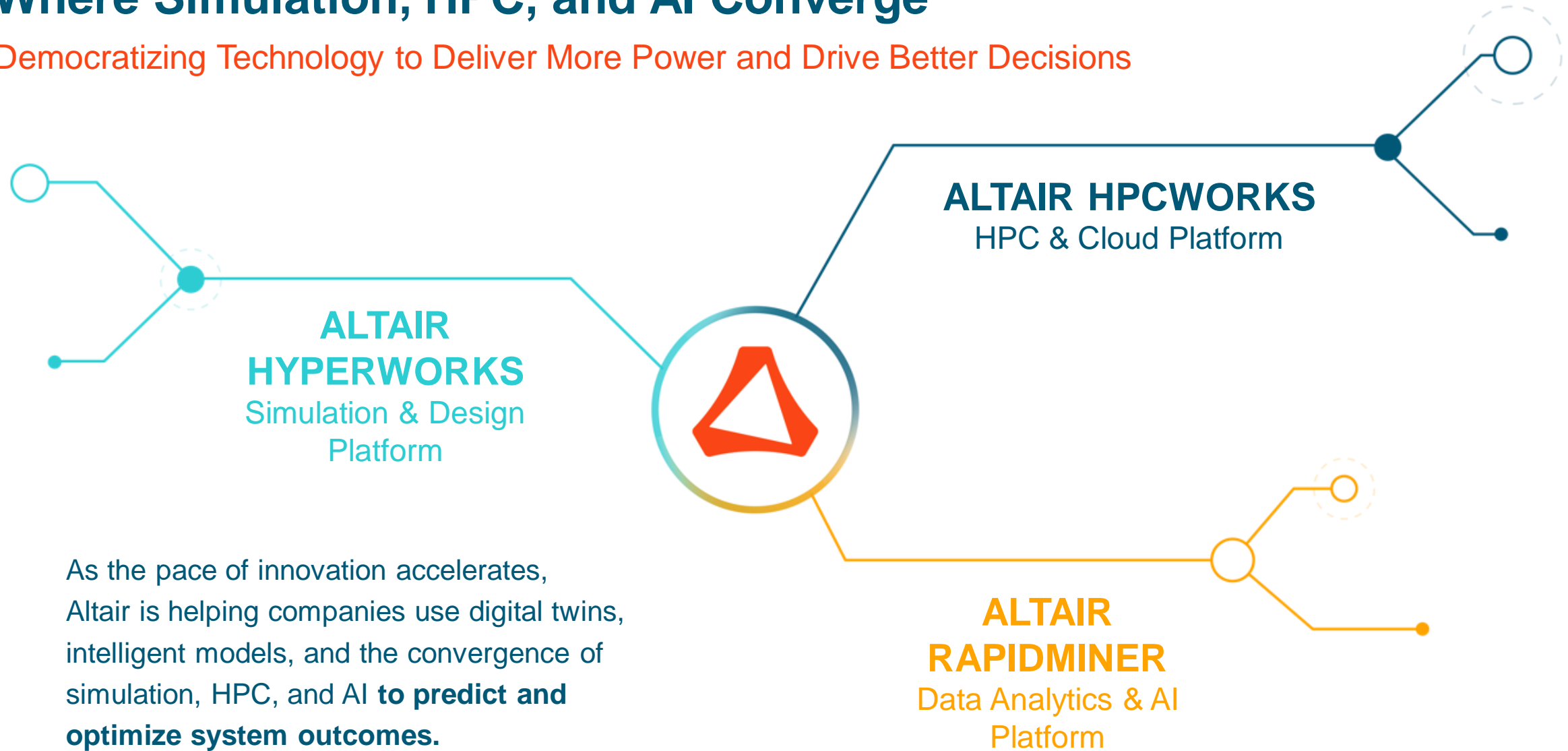
➔ Frictionless Integration of Machine Learning in CAE for Training and Prediction of Simulation Data

# CONVERGE SIMULATION, HPC AND AI



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Democratizing Technology to Deliver More Power and Drive Better Decisions



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# Altair Team Setup

Success is a journey. Let's join forces!



**Janko Stellaard**  
Account Manager  
Vision / Orchestration / Network



**Simon Zwingert**  
Senior Technical Consultant  
ModViz Products & Methods

# THANK YOU

altair.com

- Plastic Product Optimization
- Multidisciplinary Design Optimization
- Advanced Toolchain Automation
- Pre/Post/Solver
- Data Analytics / AI
- Special Disciplines

## What else do you need?

Ask us anything!