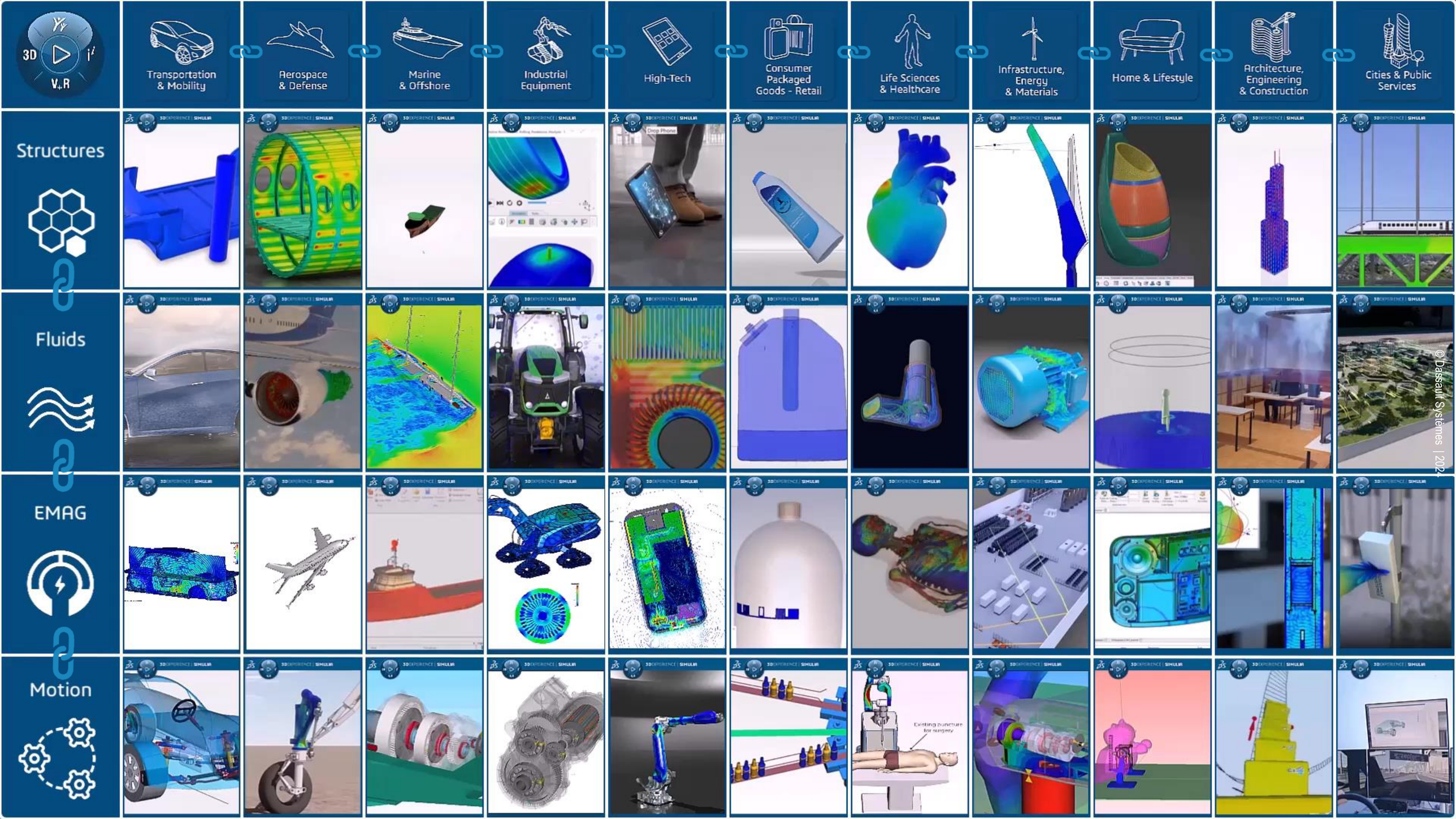
Chris
WHITING

SIMULIA R&D Senior Director
Dassault Systèmes

SIMULIA R&D – UPDATE


3D
V.R
Transportation & Mobility
Aerospace & Defense
Marine & Offshore
Industrial Equipment
High-Tech
Consumer Packaged Goods - Retail
Life Sciences & Healthcare
Infrastructure, Energy & Materials
Home & Lifestyle
Architecture, Engineering & Construction
Cities & Public Services
Structures
Fluids
EMAG
Motion
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Multi-Scale Multi-Physics

ALL PHYSICS

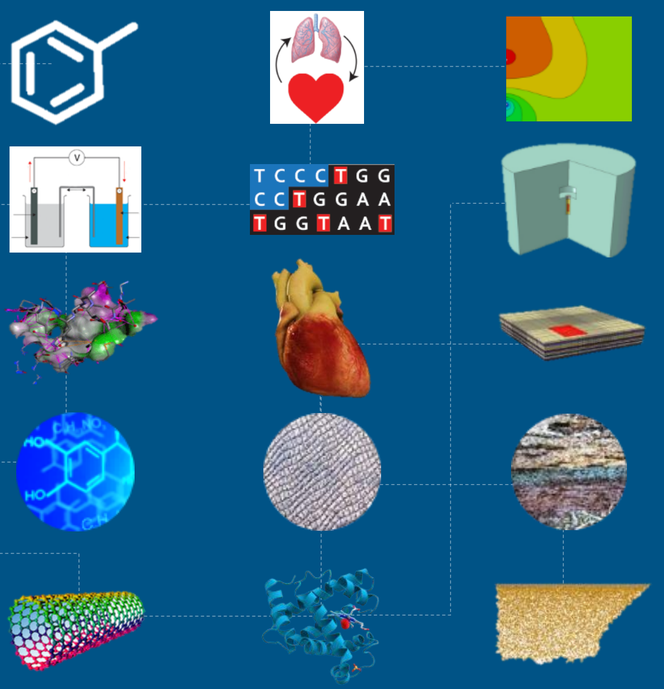
Structures & Solids | Electro-magnetics | Fluids | Thermal | Controls

ALL DOMAINS

Chemical | Bio | Geophysics

ALL SCALE

- Functional
- Logical
- Physical
  Macroscale
  Continuum
- Material Sciences
- Physical
  Microscale
  Non-Continuum



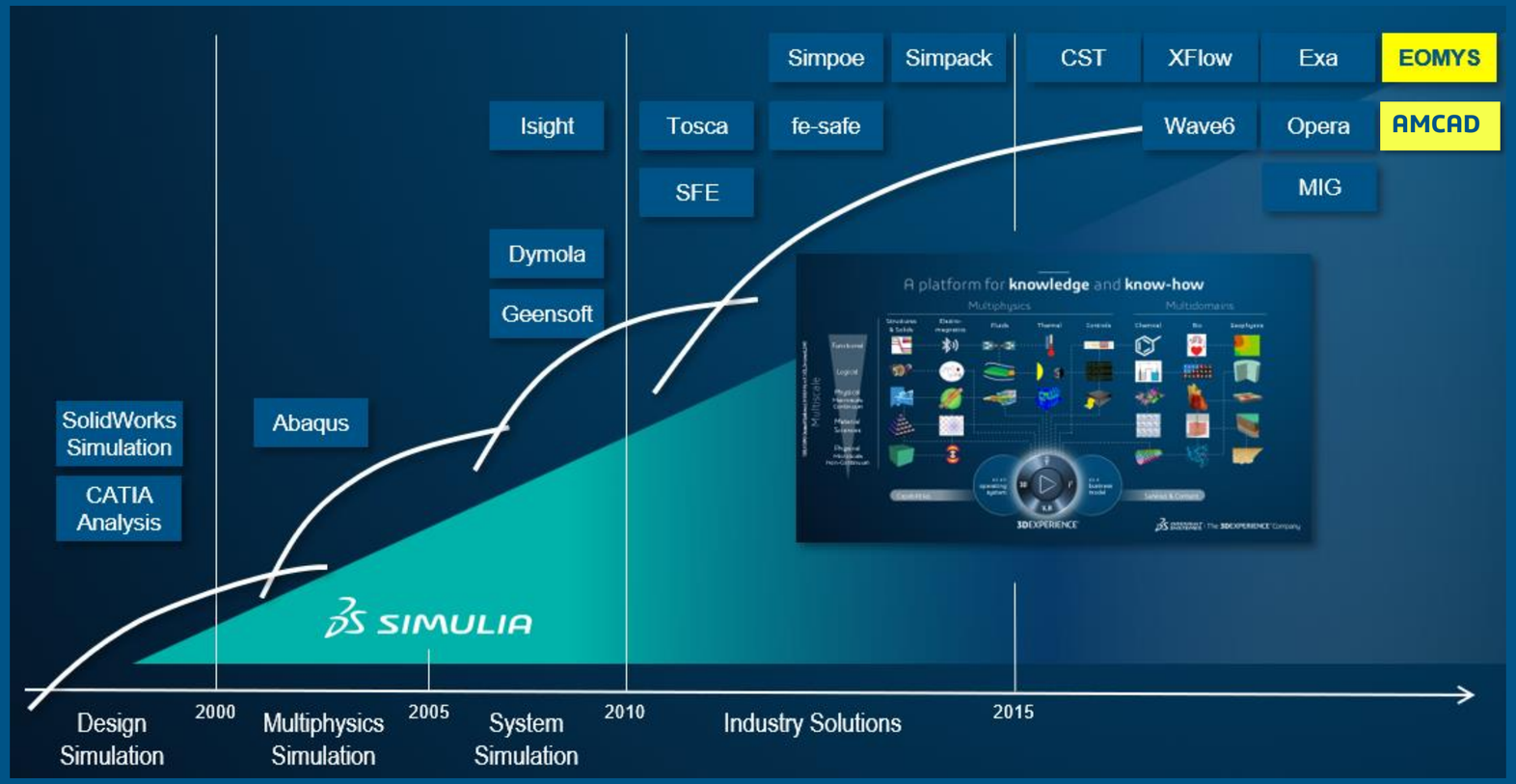
as an **operating system**

3D | i | V+R

as a **business model**

3DEXPERIENCE®

FROM WINNING PRODUCTS TO END-TO-END MODSIM SOLUTIONS

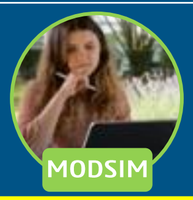
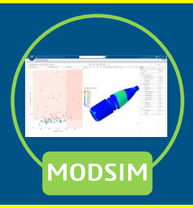
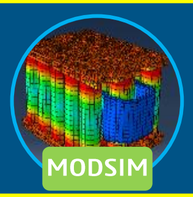


Established Product	SIMULIA Roles (Available NOW)
Abaqus/CAE	Structural Analysis Engineer, .../...
Simpack	Motion Designer, Suspension Analyst, .../...
CST-Studio	Electromechanical Analysis Engineer Electromagnetics Engineer – P'By
PowerFlow	PowerFlow Power'By
SolidWorks Simulation	Structural Performance Engineer, .../...
CATIA Analysis	Linear Structural Analysis Engineer, .../...
Isight	Simulation Process Engineer, .../...
Tosca	Structural Generative Engineer, .../...
SFE	Concept Structure Engineer, Analyst, .../...
fe-safe	Durability and Mechanics Engineer, .../...
Simpoe	Plastics Injection Engineer, .../...
Wave6	Wave6 Power'By
Opera	Electromagnetics Engineer

3DEXPERIENCE Roles bringing customers breakthrough end-to-end MODSIM value

SIMULIA R&D STRATEGIC DIRECTIONS

MODSIM

		Simulation Democratization
#1		Multi-discipline Design Exploration powered by AI
#2		Multiphysics & multiscale simulation technology
		Concept Engineering
		Engineering for Manufacturing
		Large-scale simulation modeling and analysis

MODELING & SIMULATION

MODSIM

SOLIDWORKS

CATIA

SIMULIA

3D i² V.R

other CAD

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MODSIM:

MODSIM unifies modeling and simulation on a common data model

within a single user experience on the **3D**EXPERIENCE platform

Press ⇧+F11 to exit full screen mode.

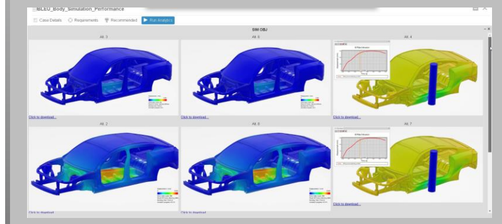
Essentials View Tools

JOURNEY TO MODSIM
EXAMPLE FOR TRANSPORTATION & MOBILITY INDUSTRY

Greater Product Complexity

Concept Engineering

1



Generative Component Engineering

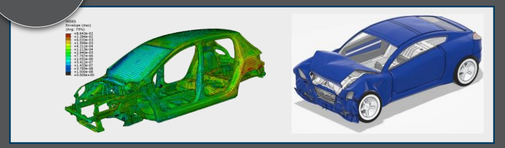
2

Vehicle Validation

Body & Vehicle Validation

Time-scale = weeks

5



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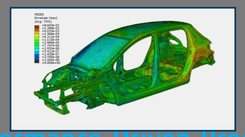
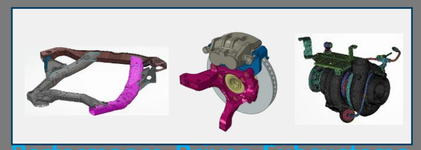


Performance-Driven Products

Time-scale = ~hours

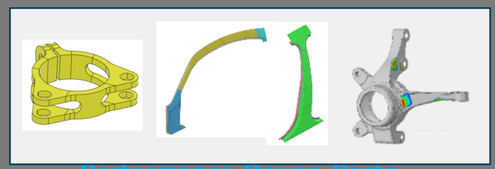
Subsystem Engineering



Performance-Driven Subsystems

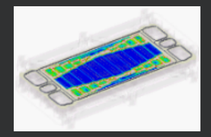
Time-scale = minutes

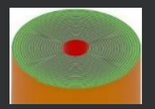
Part Design



Performance-Driven Parts

4 Multi-Physics Multi-Scale





Greater Simulation Complexity

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#1

A CANDIDATE FOR THE WORLD'S MOST COMMONLY ASKED QUESTION…

Q: How is SIMULIA R&D leveraging AI to improve simulation?

SIMULIA R&D STRATEGIC DIRECTIONS | AI-AUGMENTED MODSIM

Design Evaluation And Exploration

- Performance Prediction
- Design Guidance
- …

User Assistance with AI Experiences

- Natural Language Access to Help
- Natural Language-driven Command Automation
- …

AI Assisted Simulation Authoring

- Automated Simulation set up (model, scenario)
- Results Interpretation
- …

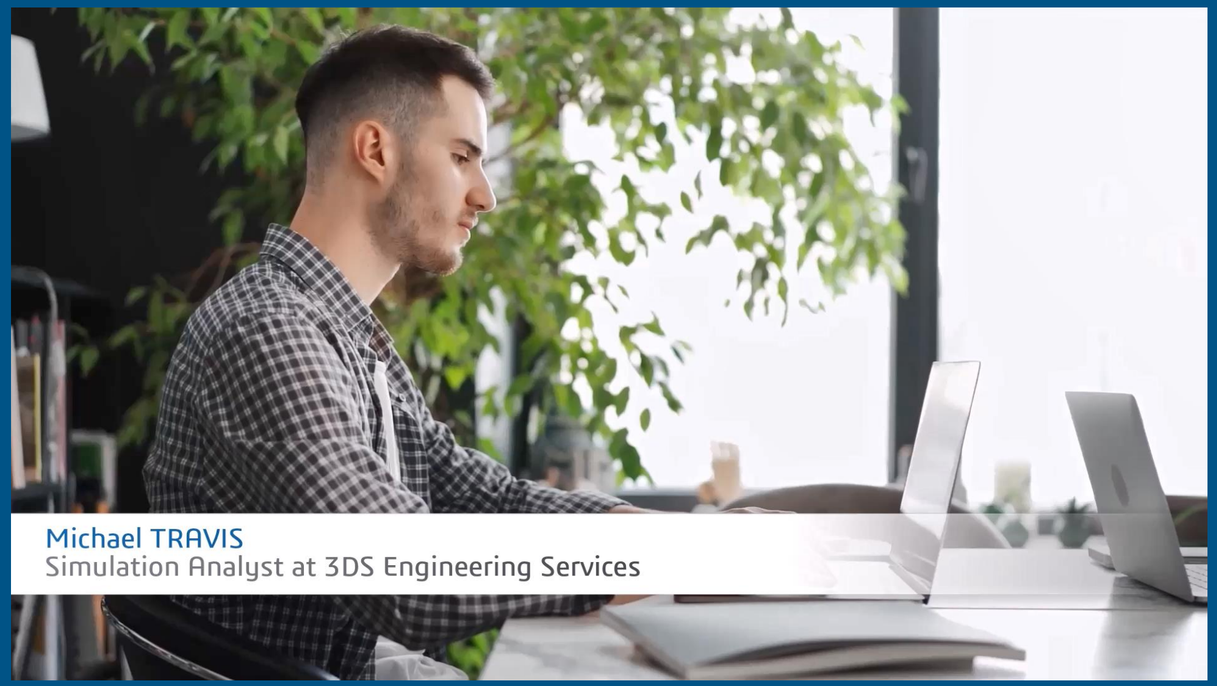
Data Assets

Simulation Data Assets Management

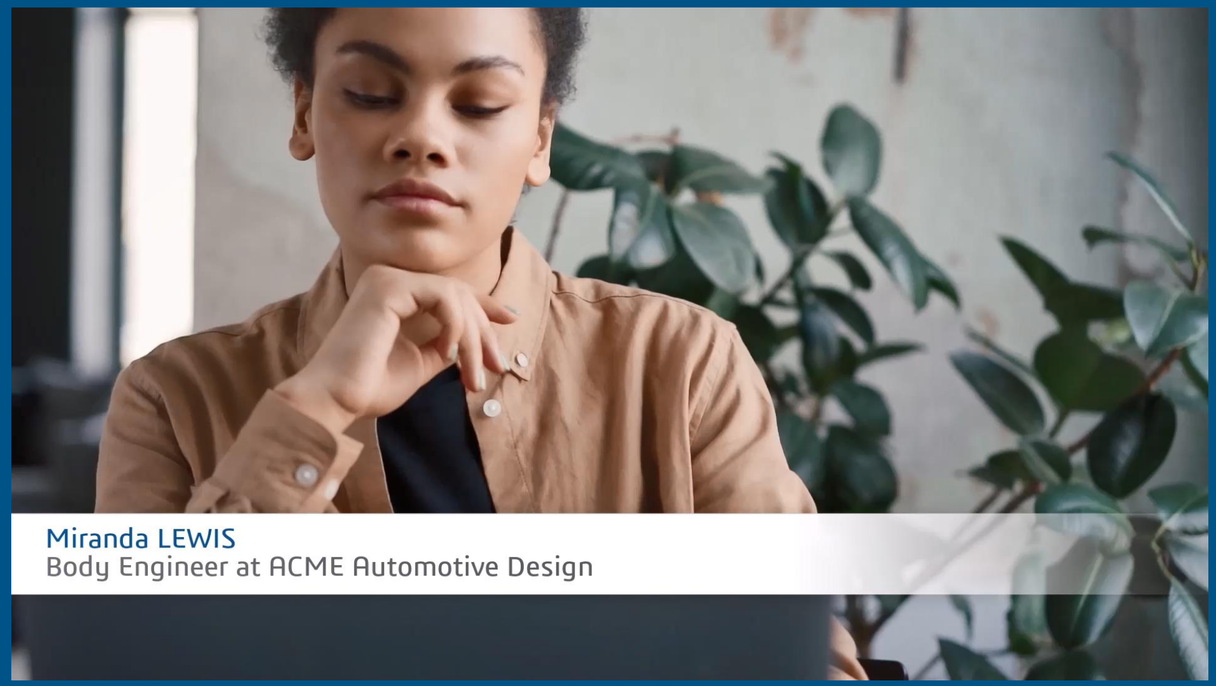
Foundation for AI-enabled products and services

1

AI | DEMOCRATIZATION VIA MACHINE-LEARNING PHYSICS MODELS



Michael TRAVIS
Simulation Analyst at 3DS Engineering Services



Miranda LEWIS
Body Engineer at ACME Automotive Design

Simulation Analyst

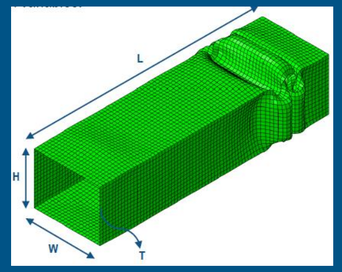
- Decides which KPIs are needed to validate designs
- Creates and validates simulation scenarios
- Creates and deploys ML-Physics Models

Product Engineer

- Creates product designs
- Leverages ML-Physics-Models to simulate design alternatives
- Compares alternatives based on physics KPIs

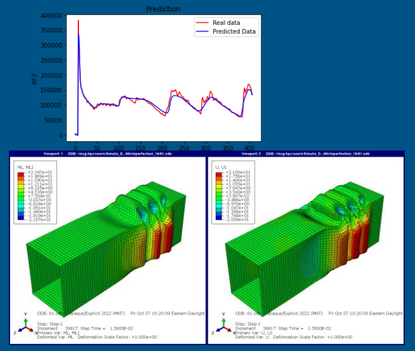
AI/ML PHYSICS MODELS | CHALLENGE MODELS, PARAMETERS/KPIS 1/2

M1 – dynamics

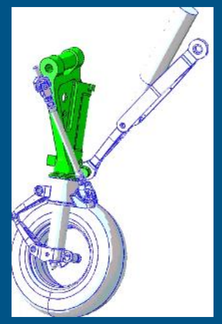


Parameters
- W
- H
- L
- T

KPIs
- Scalar RF
- 3D Deformations

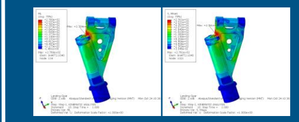


M2 - statics

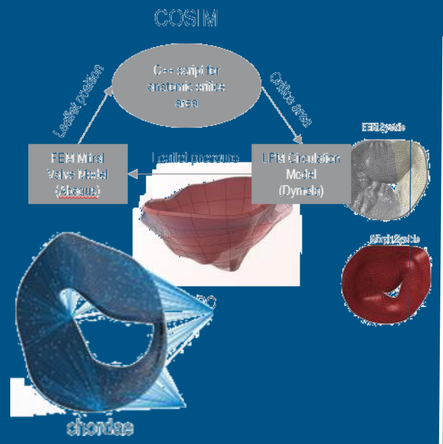


Parameters
- F_x
- F_y
- F_z
- $x_{strut}^{extension}$

KPIs
- 3D Stresses

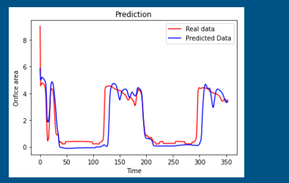


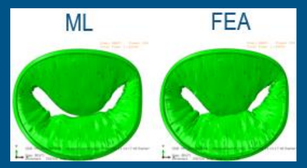
M3-multiphysics



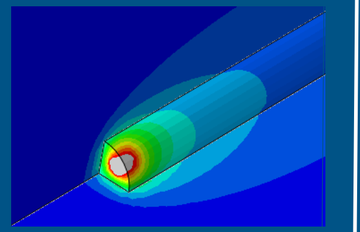
Parameters
- 23 parameters
- Geometry
- Materials
- Chordae lengths

KPIs
- Opening area
- 3D Shape of this area



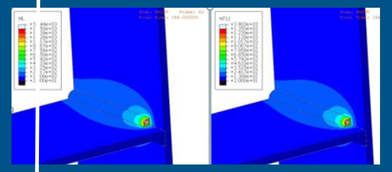


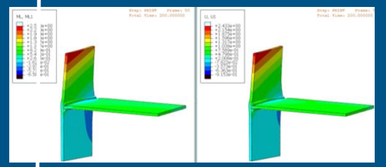
M4 - welding



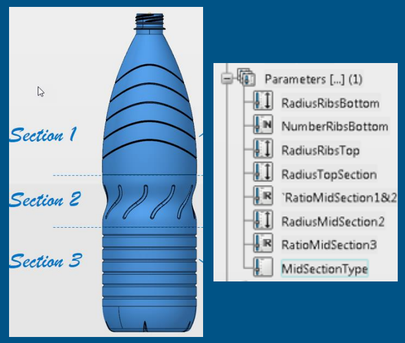
Parameters
- Power
- Velocity
- Laser angle

KPIs
- 3D Temperatures
- 3D Deformations



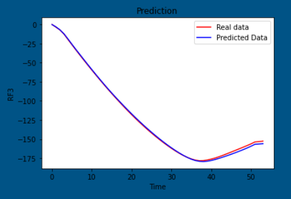


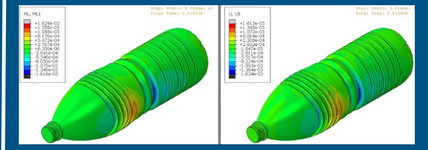
M5 - buckling



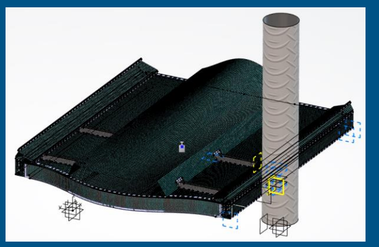
Parameters
- Top: radius
- Top: ribs depth
- Top: ribs pitch
- Top: ribs spacing

KPIs
- 3D Deformations
- Top load evolution



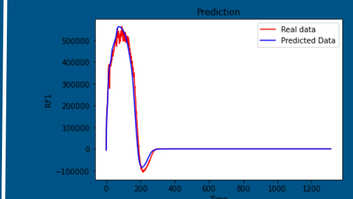


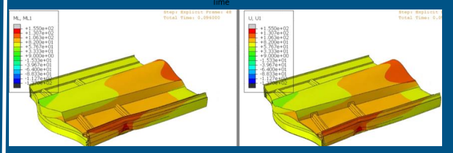
M6 – battery safety



Parameters
- Pack dimensions
- Thicknesses

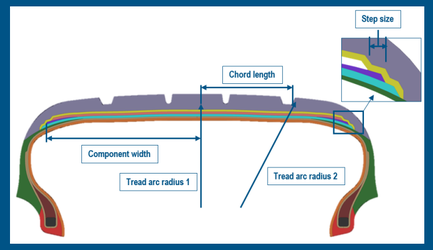
KPIs
- Sidepole reaction force
- 3D deformations





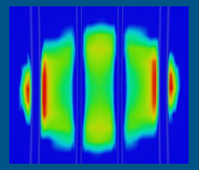
AI/ML-PHYSICS MODELS | CHALLENGE MODELS, PARAMETERS/KPIS 2/2

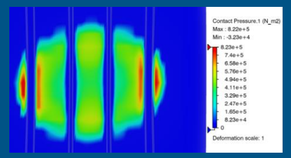
M9 – Tire footprint



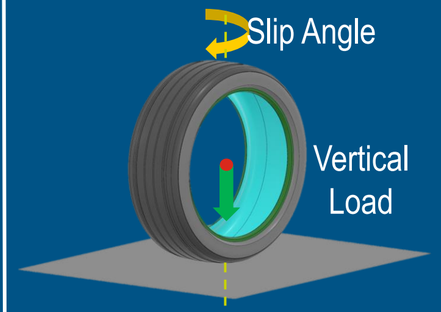
Parameters
- Width
- Chord length
- Arc radius 1
- Arc radius 2
- Step size
- Internal pressure

KPIs
- Footprint pressure
- 3D Deformations



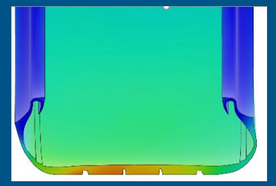


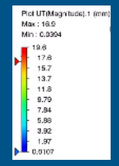
M10 – Tire lateral slip

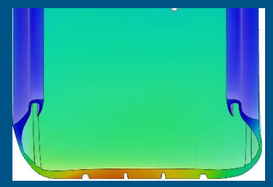


Parameters
- Vertical load
- Slip angle

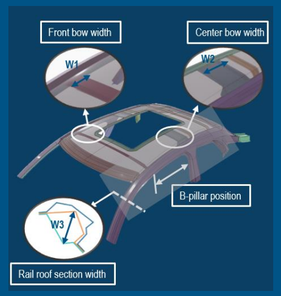
KPIs
- Tire deformations





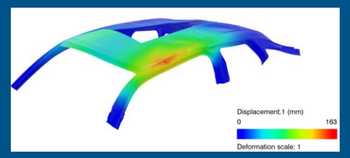


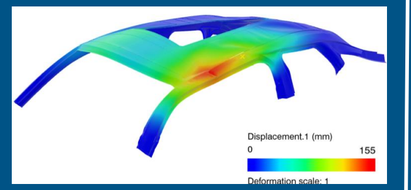
M11-Roof crush



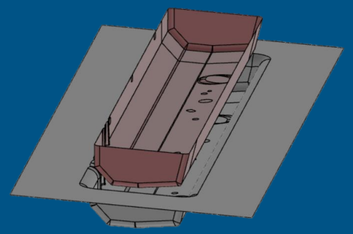
Parameters
- B-pillar position
- Roof rail width
- Center bow width
- Front bow width

KPIs
- Reaction forces
- Deformations



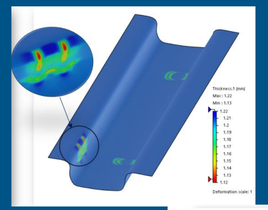


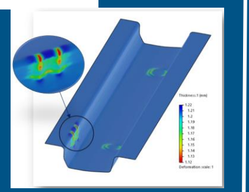
M12 -Stamping



Parameters
- Die entry radius
- Friction
- Holding Force
- Local Radius
- Face angle

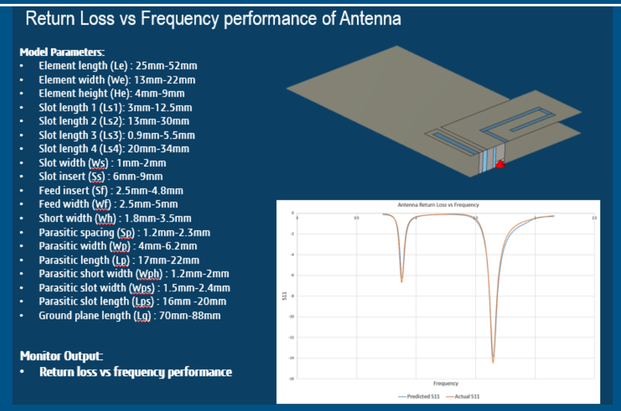
KPIs
- 3D Deformations
- Thinning





Other ongoing efforts

M13: Wheel aerodynamics
M14: Pedestrian hood head impact
M15: Electromagnetics filter design
M16: Electromagnetics antennas (below)

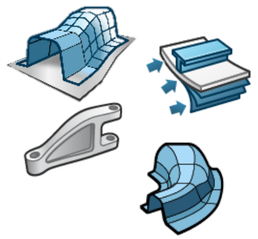


ML-PHYSICS-MODELS AS A SERVICE - ON THE **3D**EXPERIENCE CLOUD

COMING SOON...

3DS Engineering Services

PARAMETRIC DESIGN



Initial Design

Create a parametric model with robust variability

SIMULATION SCENARIO

Physics Simulation

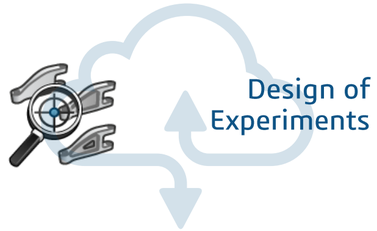
Create a parametric physics simulation with robust variability

DESIGN SPACE & KPIs

Define KPIs, parameters, targeted accuracy of ML Physics model

MACHINE LEARNING TRAINING AS A 3DS SERVICE

SYNTHETIC DATA GENERATION



Design of Experiments

Run simulations to generate training data covering the target design-space

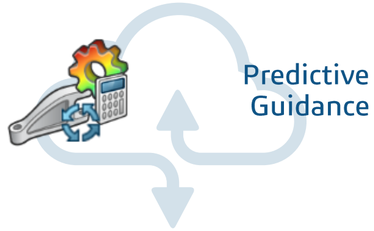
MACHINE LEARNING TRAINING

Train Machine Learning Model

Create model surrogation study using existing data

Generate data to train and validate an accurate Machine Learning physics model for AI prediction

AI PREDICTION



Predictive Guidance

Predict performance instantaneously

You, our customer

#2

3DEXPERIENCE Platform for breakthrough MODSIM solutions based on Multiphysics-Multiscale Simulation

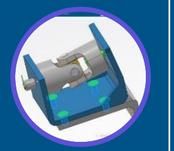
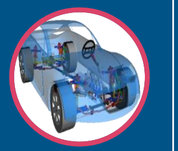
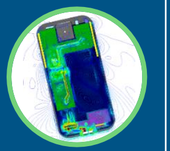
DASSAULT SYSTEMES

MULTIPHYSICS-MULTISCALE WORKFLOWS

Full 3DEXPERIENCE workflow

Supported workflow

New in 24x-25x

From: \ To:	Design	Structures 	Motion 	Fluids	Electro-magnetics 
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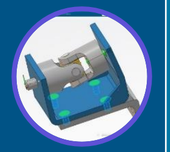
Structures 	✓	✓	✓ ★	✓	✓
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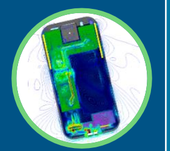
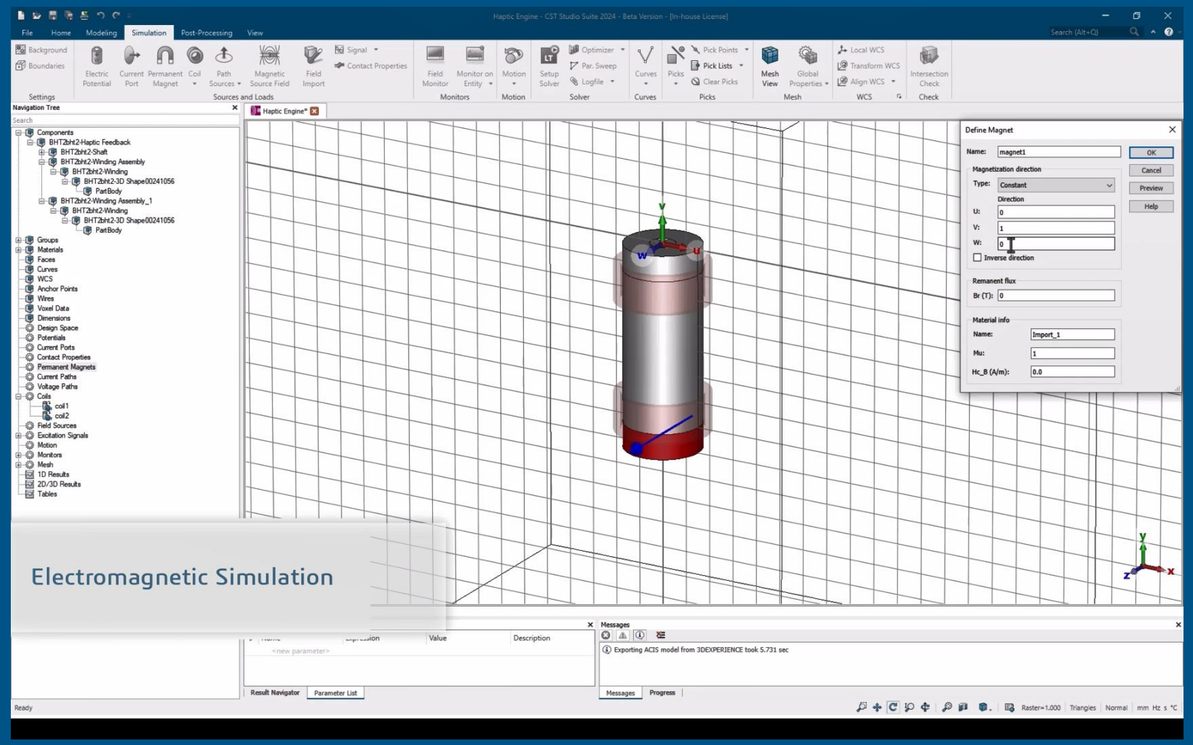
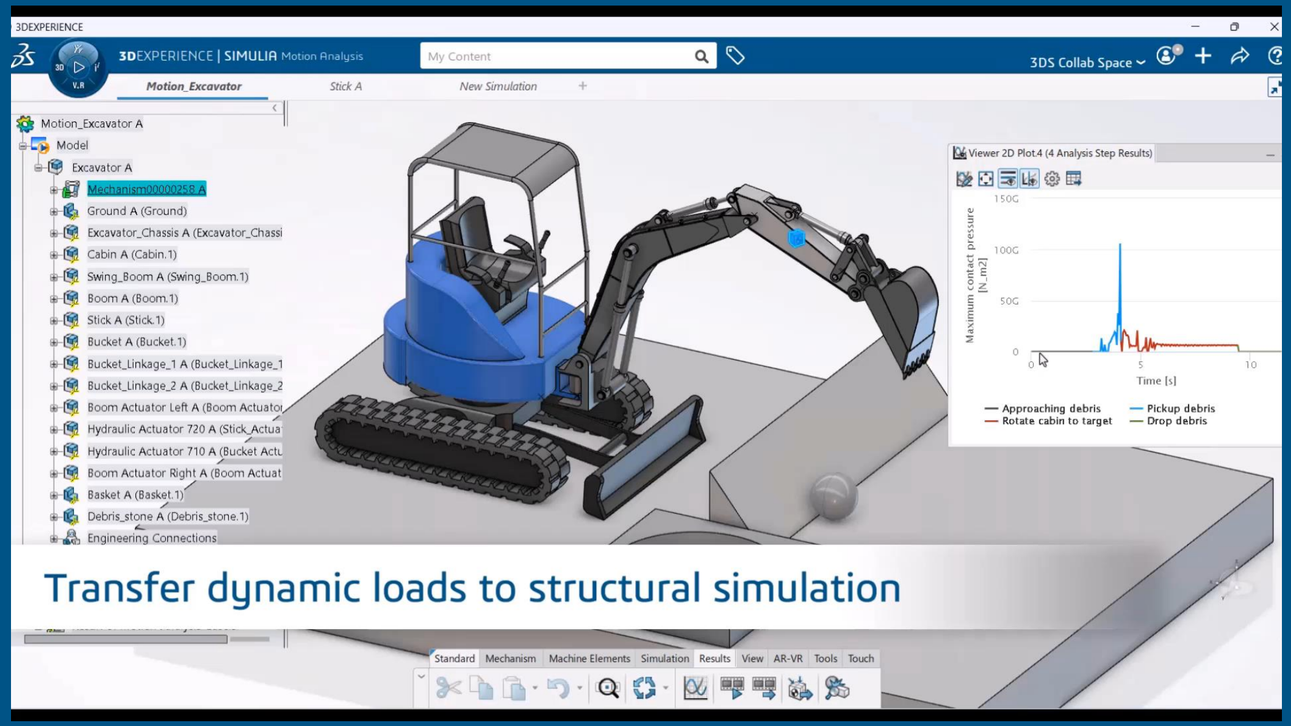
Fluids	✓	✓		✓	✓
Electro-magnetics 		✓ ★	✓ ★	✓	✓ ★

EXAMPLES | NEWLY AVAILABLE 1/2

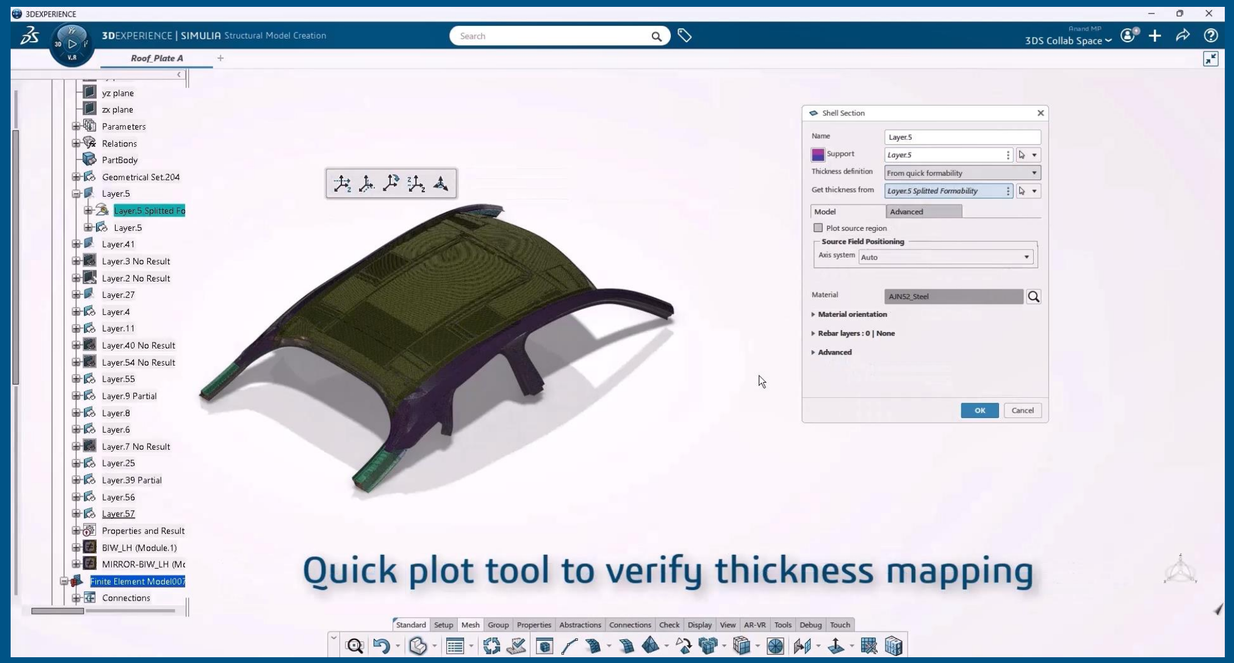


Electromagnetics to Structure coupling
CST → Abaqus

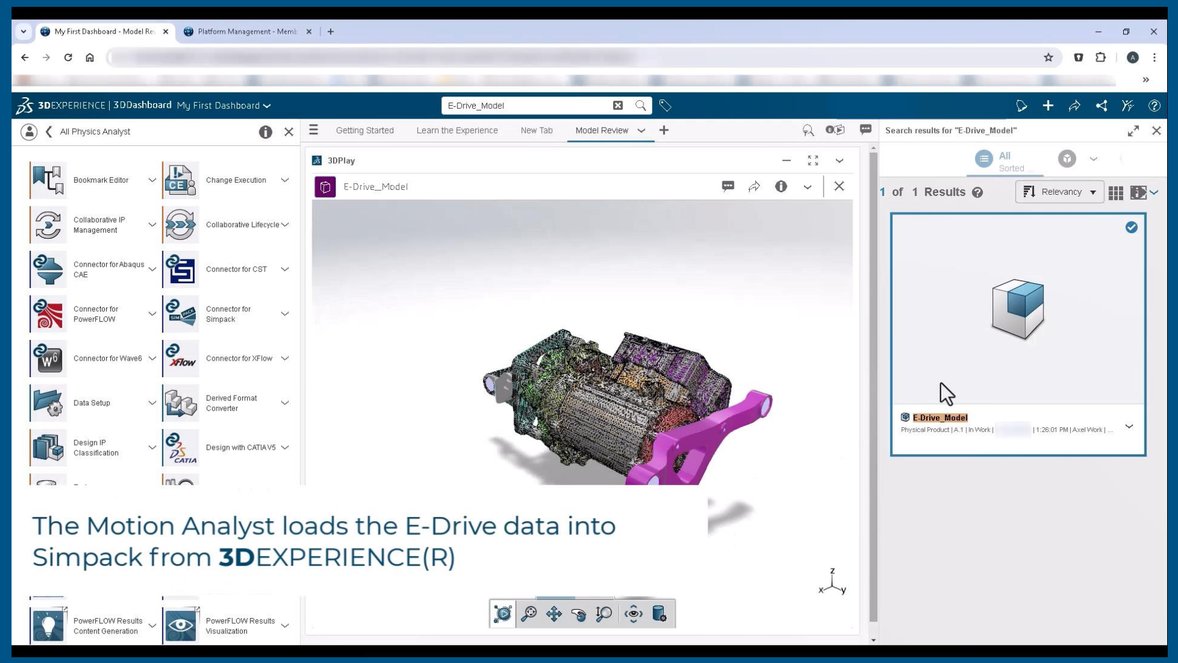


Motion to Structure coupling
Simpack → Abaqus

EXAMPLES | NEWLY AVAILABLE 2/2



CATIA Die Design to Structure coupling
CATIA → Abaqus



Electromagnetics to Motion coupling
CST → Simpack

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DASSAULT SYSTEMES

Virtual Worlds
for Real Life

THANK YOU FOR YOUR INTEREST