

Artificial Intelligence-Driven Composites Virtual Twins in the 3DEXPERIENCE Platform– Industry World Models

Etienne Ardouin¹, Florent Savine²

¹ Etienne Ardouin (Dassault Systemes, Woodland Hills, California), etienne.ardouin@3ds.com

² Florent Savine (Dassault Systemes, Velizy, France), florent.savine@3ds.com

The increasing complexity and wider applications of composite materials and their manufacturing processes demands a new paradigm in engineering design — one that transcends conventional simulation-driven workflows and embraces the transformative potential of Artificial Intelligence. This presentation investigates a series of integrated AI applications spanning the full composites engineering value chain, from materials characterization at the microstructural scale through to intelligent manufacturing process planning, all realized within the industrial context of Dassault Systèmes' 3DEXPERIENCE Platform.

At the materials scale, Machine Learning models developed within the BIOVIA and SIMULIA environments are employed to predict constitutive material behavior directly from microstructural descriptors, substantially reducing the reliance on costly and time-intensive physical testing campaigns. These data-driven surrogate models demonstrate strong predictive fidelity across a range of fiber-reinforced composite architectures, offering a computationally efficient pathway to virtual material qualification. At the structural and thermal analysis scale, AI-augmented simulation methodologies within SIMULIA are explored to enable real-time design feedback loops for macroscopic composite assemblies operating under complex multi-physics loading conditions demanded by aerospace and automotive certification standards.

Beyond simulation, this work introduces the concept of Agentic AI in the form of Virtual Companions — autonomous, context-aware AI agents embedded within CATIA for Composites Design Engineering and DELMIA for Manufacturing Process Planning. These companions assist engineers by interpreting design intent, facilitating design change for alternative laminates strategies, flagging manufacturability constraints, and dynamically sequencing production operations, effectively acting as intelligent co-engineers throughout the product development lifecycle.

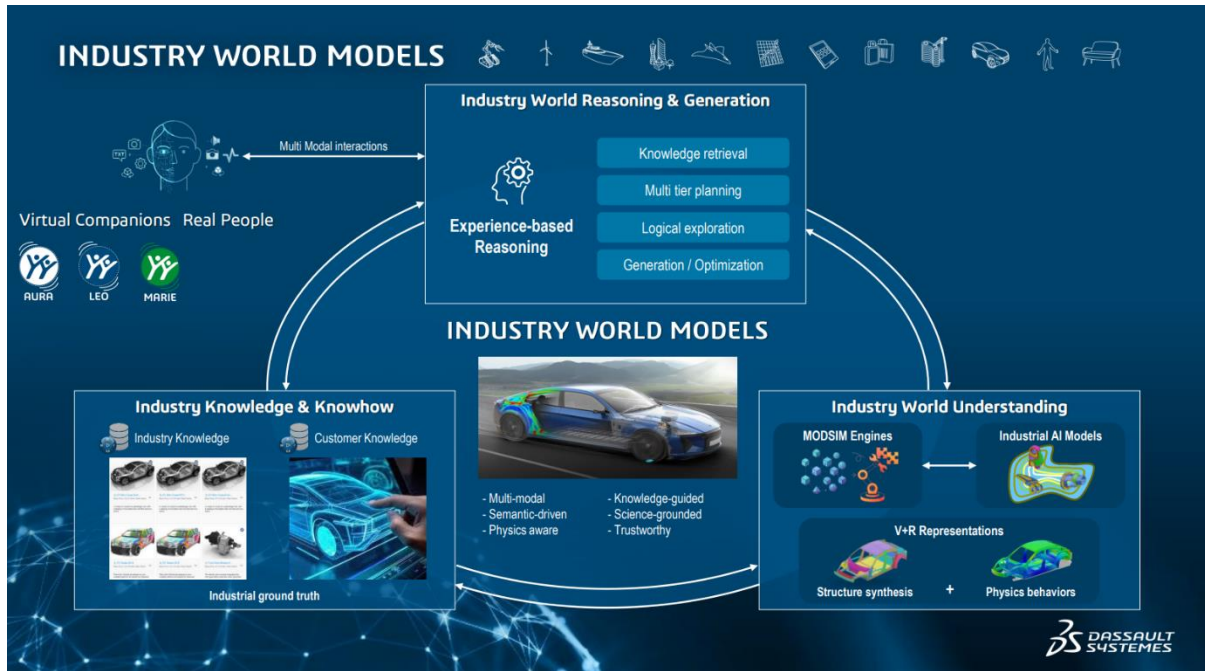
Collectively, these advances illustrate a cohesive, platform-native AI strategy for composites that is both scientifically rigorous and industrially deployable.

References:

- [1] Dassault Systemes WhitePaper: "[Introducing industry world models](#)"
- [2] V. Oancea, J. Bi, S. Chen "Fine-Scale Feature Preservation-Oriented Geometric Pre-training for AI-Driven Surrogate Modeling" – April 2025 - DOI:10.48550/arXiv.2504.20110
- [3] F. Savine "Explicit composite ply location, orientation and shape optimization via a feature-mapping method" - May 2025 - WCSMO-16
- [4] F. Savine "Simultaneous optimization of unconventional stiffener layouts and composite layups applied to large cylindrical shell structures" - 2022 Phd thesis, Sorbonne Université

[5] Dassault Systemes WhitePaper: “[AI-Driven Generative Experiences](#)”

[6] NVIDIA Article: “[How Industrial AI and Digital Twins Accelerate Design, Engineering and Manufacturing Across Industries](#)”



Industry World Models introduction at NVIDIA GTC 2026 Conference