SIEMENS
Ingenuity for life

Simulation & Digital Twin

Company Core Technology

Background

The digital twin concept sits at the center of digitalization, linking all models and data related to products, their production, and their operational performance and providing them to designers, engineers, operators and service technicians across vertical domains.

A Siemens digital twin for products is typically created using our Systems Driven Product Development (SDPD) methodology, which drives the creation of intelligent system models. Technologies like generative and probabilistic design, system simulation and model transformation are the basis for these intelligent models.

Key enablers for SDPD include our comprehensive, semantic digital thread data model in Teamcenter, as well as a complete set of integrated tools, which include Amesim, Simcenter, STAR-CCM+, and HEEDS. These tools help to create model-based system representations and digital twins of the product. These digital twins are able to comprehend the impact of design changes on the production system and provide engineers, operators and service technicians with essential information to optimize the use and performance of a product and prevent system outages. Technically, this is realized by combining virtual models and real-life data, thus creating "hybrid models" of physical assets keeping the digital twin in sync with the real world.

In addition to providing Siemens customers with tools to create and use digital twins for their own products, Siemens also creates digital twins of its own products, systems and solutions to enable customers to optimize their use. In the cooperation with Bentley, Siemens expands the concept to digital twins of infrastructures. Digital services enabled by MindSphere leverage a whole ecosystem of new business opportunities in this field.

Importance for Siemens

With a comprehensive suite of CAD, simulation and product-data management tools, as well as MindSphere as the open IoT operating system, Siemens aims to provide its customers with the most comprehensive digital twin offering on the market.

Success stories and research focus

Create better products faster

Already at an early design stage, digital twins paired with fast simulation technology for fluid dynamics, electromagnetics or acoustics can shorten design cycles from several weeks down to just one day. One of the most ambitious R&D projects is the E-Fan X project, driven jointly by Siemens, Airbus and Rolls Royce. This project aims to demonstrate a hybrid-electric propulsion system in a relatively large aircraft based on a 100-seat BAe146 by 2020. Meeting the roadmap goals in time is only possible by using the Simcenter suite offered by Siemens PLM software: Digital twins are iteratively being built to virtually optimize the prototypes. Not only does this accelerate the development, the fast design iterations also enable the power density increase of the drive system that is needed to make the concept feasible.

Boost efficiency

The planning of commercial, industrial and public buildings worldwide has to become increasingly efficient and cost-effective without a loss in quality. Thanks to rapid IT developments in recent years, an initial answer to these challenges already exists today: Building Information Modeling (BIM). This comprehensive working method is revolutionizing construction processes using 3D data. They reflect the geometric data of all building elements, schedules and budgets for the entire project as well as all relevant energy supply, lighting, fire safety and building management data.

One key innovation of BIM is the use of semantic information to facilitate the flow of information between different stakeholders. This idea is now being adapted to other domains, a move that is boosted by the collaboration of Siemens and Bentley and by a joint approach to use cases in several customer domains within the Company Core Technology Simulation & Digital Twin. For example, in energy management as well as in rail electrification, the BIM concept can enable more efficient ways of managing assets and simulating energy flows.

Real-time simulation

One of the benefits of a pervasive digital architecture that enables physical assets in the field to continuously interact with their digital twins, both embedded in the device itself and mirrored in a cloud-based environment on MindSphere, is the ability to monitor their current condition, simulate their future behavior, and thus optimize their use and prevent outages – all in real time!

This raises the need to develop new solutions that leverage ever-increasing computing power while at the same time reducing mathematical complexity and abstracting models for field use. The ultimate goal is that simulation algorithms can be computed in real time so that they can run in parallel to the physical process, providing the user with enhanced decision support on optimal usage by means of augmented reality and virtual sensing. By realizing these opportunities, the digital twin finally reaches all life cycle phases, and it closes the feedback loop back to the design of a new generation of better, even more user-centered products.

Further information

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