Full lifecycle digital twins are changing the game for chemicals

Modern advanced process simulation enables manufacturers to optimise operations, cut costs and expedite development times, says Stephen Reynolds of AVEVA

BY REBECCA GIBSON

Advanced process simulation (APS) is transforming how chemical companies operate by decreasing the time it takes to test and scale new chemical formulations and empowering them to optimise operations, cut costs, drive innovation and remain compliant with industry regulations. Stephen Reynolds, industry principal for chemicals at AVEVA, explains why the technology offers such potential, particularly when combined with cloud and AI solutions.

What is the state of the global chemicals industry and what are the biggest challenges it faces?

The global chemicals market is fast-moving and shaped by dynamic pressures. The industry must constantly innovate within tight time frames while managing volatile demand, supply chain disruptions and ever-increasing regulations.

Amid rising global costs and a high compliance environment, manufacturers are looking to boost operational efficiency while meeting sustainability key performance indicators. In practice, this means introducing solutions for agile and reliable operations, while reducing emissions and energy consumption. Firms are also looking to optimise yields, reduce waste and enable green chemistry to sharpen their competitive edge.

Chemical companies must keep up with evolving red tape and legislation, which requires ongoing investment in technology and process adaptation. Additionally, the industry is under pressure to undertake digitalisation to help attract, train and retain a new generation of engineers. The need for faster time-to-market and expedited R&D processes is also paramount.

How is APS revolutionising the digital twin?

APS, specifically AVEVA APS, enhances digital twins by integrating engineering models, real-time data and operational visualisation tools to provide a continuous digital representation of physical assets, ensuring a smooth transition from basic design to detailed engineering and then to operations.

"APS helps chemical companies innovate faster, reduce costs and stay competitive"

Engineers have historically grappled with using multiple specialised simulators, between commercial and in-house tools and often a lack of customisation capabilities. However, modern APS brings all the relevant tools together in one place. It unifies multiple processes into a single, integrated platform to design a chemical plant, predict its future dynamic behaviour and improve operations after the plant startup. All of this adds up to transformative accuracy, efficiency and speed

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gains, enabling chemical manufacturers to gain ground amid a crowded global stage.

Traditionally, digital twins have been used to build plants. How can 'lifecycle' digital twins optimise benefits from project phases to operations support?

APS enables the lifecycle digital twin by creating a simulation model at the conceptual design phase, which then evolves throughout the project's lifecycle. This model integrates sizing, control loops and all necessary information up to the plant's startup.

After commissioning, the same model can connect to real-time data, enabling troubleshooting and operational optimisation. This approach eliminates the need for separate design and operations process simulators, streamlining efficiency and accuracy.

Can you give us an insight into how APS is supporting and transforming the industrial chemicals sector specifically?

The technology enables quick process modelling and iteration, reducing the time required for testing and scaling new chemical formulations. Engineers benefit from an open-model writing environment that allows them to create new operating units when they need to, without complicating coding.

APS can connect to real-time operational data through AVEVA PI System, allowing companies to adjust operations based on actual chemical plant performance.

Critically, APS also helps companies reduce energy consumption and optimise chemical reactions, lowering operational costs and carbon footprints. In addition, APS can be incorporated into integrated AI-driven analytics solutions, which help identify inefficiencies and opportunities for improvement while predicting chemical hazards before they occur.

How does APS, running on Microsoft Azure, enable agile development of new processes and products to support chemicals customers?

APS running on Azure leverages the power of the cloud to provide fast, flexible and scalable process simulation, allowing companies to reduce time to market and develop more innovative and sustainable products.

Historically, process engineers may have had to carry several heavy laptops and wait days for model results. With the cloud, engineers simply require a browser and a high-speed internet connection to run complex models.

APS running on the cloud allows global teams to work on the same digital twin model, ensuring consistency. This saves time, costs, and valuable personnel hours, particularly in a landscape where chemical engineering resources are increasingly scarce. Companies can also scale their computing power based on project needs, reducing reliance on expensive on-premises infrastructure.

By speeding up design cycles, enabling AI-driven process optimisation and ensuring sustainability, APS helps chemical companies innovate faster, reduce costs and stay competitive in a rapidly evolving market.

How is AI shaping the future of process simulation within chemicals?

AI is revolutionising process simulation by making models smarter, predictive and self-optimising. APS can be connected with popular machine learning packages like Open Neural Network Exchange for high-speed simulated modelling, allowing the digital twin to analyse trends, optimise conditions and recommend real-time adjustments. ■

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