More analysis requires more management

The calculation departments at the famous German sports carmaker Porsche use comprehensive data management for simulation to make their engineering fit for the future.

By Dr BERNHARD D. VALNION

Simulation and calculation have long been established as a valid basis for major management decisions, for example in the broad field of autonomous driving. For this, however, the individual development disciplines must be more closely interlinked than before, especially as new analysis methods and huge amounts of data are added. This requires a new quality of CAE data management, as it is important to work together even more intensively on future topics in the context of a collaborative infrastructure of creativity. The leading sports carmaker Porsche is more than aware of this trend, which is why it decided to make a long-term investment.

„Outstanding data management solutions that meet these requirements call for a partnership on an equal footing."

Dirk Ruschmeier, Porsche

One of Porsche's secrets of success has always been extensive testing of its vehicle designs. As early as 1953, a small airfield not far from Stuttgart, Germany, was used for what we would call 'physical tests' today. Finally, in October 1961, the first groundbreaking ceremony took place for the construction of what later became the development center and test tracks in Weissach. At the end of the 1960s, plans for the Porsche development center in Weissach began to take shape, and in autumn 1971 the entire R&D team was relocated from Stuttgart-Zuffenhausen to Weissach.

But with the use of simulation and calculation, too, they have always been at the forefront. "What has made Porsche great is engineering genius. Today, we can proudly say that people, processes, and methods in the CAE area have made a significant contribution to achieving our technical and economic goals," said then the Head of Calculation and Simulation with Porsche, Christoph Gümbel, to the editors of CADplus many years ago (1). And indeed, ingenuity is always visible at the sports carmaker, for example in the form of method and process excellence in the construction and use of digital prototypes (discipline-specific CAE models). Therefore, the automotive OEM is systematically investing in the expansion of its CAE IT infrastructure through the strategic further development of its CAE data and process management (SPDM) based on the SimData Manager and technologies from PDTec AG based in Karlsruhe, Germany.

Up, up to the sky

The implementation of an SPDM dates back to 2008. Back then, a dedicated tool was introduced after initial preliminary investigations of various vendor solutions in selected departments. In the years that followed, a comprehensive solution was developed together with the selected software vendors, and from 2010 the first 3D CAE process chains, for example in crash and strength calculations, could be largely captured and used productively.

The SPDM now supports the process steps from model creation to simulation setup and running the calculation job to evaluation, analysis, and documentation. Some steps in the department processes are partially automated using Python scripts developed in-house. The upstream process steps of the formulation of input data requirements for CAD data, technology data and functional models as well as their central data compilation and provision for the simulation disciplines are currently mapped in other IT systems. "Over many years, my colleagues have established a very structured, tool-supported process in which the input data, in particular CAD data and technology data for given vehicle configurations, is collected about every six months on so-called 'main data availability dates' in a vehicle project, evaluated according to various criteria and then made available centrally," explains Dirk Ruschmeier, Head of PDM Data Management & Data Exchange with Porsche, in an interview with our editors. In the area of CAD data, the OEM uses the so-called Porsche DMU ('P-DMU') based on the Enovia platform from Dassault Systèmes. For the technology data, the technology data management (TDV) was set up as an in-house development with the vendor Exxcellent Solutions, for function data, function models, and configurations (function data and model management, FDM), an in-house development based on the PDTec platform ice.NET is used.

Picture: Porsche

Precisely tailored to the needs of the individual

Not every calculation discipline uses every process step that could be supported as part of CAE data management. Some only store the results of their calculations in PDTec's SimData Manager. Others, on the other hand, carry out model creation in a highly automated process, for example the crash calculation and vehicle safety using the Loadcase Composer (LoCo, a tool provided by Scale). Still other areas use the entire spectrum of the supported process steps up to the automatic creation of reports. Porsche's SPDM offers the possibility of connecting discipline-specific CAE solvers as well as pre- and post-processors via powerful interfaces. This enables combined central data storage and central functionalities for all departments with very individual needs. "We want to create as much transparency as possible in all calculation disciplines by collecting the data centrally in the SPDM database," explains Mr Ruschmeier. However, it is always a question of weighing up the extent to which individual specialist processes should be harmonized. Which data should be stored where and for how long? Ultimately, the goal is to enable the analysis results to be traced back to the input data. "The calculation engineers have very clear ideas about added value in process support. They don't want to be put into a corset, they want their work processes to be as efficient as possible," says Mr Ruschmeier, pointing out that the target group has a high affinity for individual processes and self-programmed solutions. In addition, more and more CAE tools come with their own database to simplify their data handling and enable new functionalities. "That's why we're taking the path of storing the data in these vaults only temporarily and only carrying out persistent data storage in the SPDM system," says Mr Ruschmeier, explaining the underlying strategy.

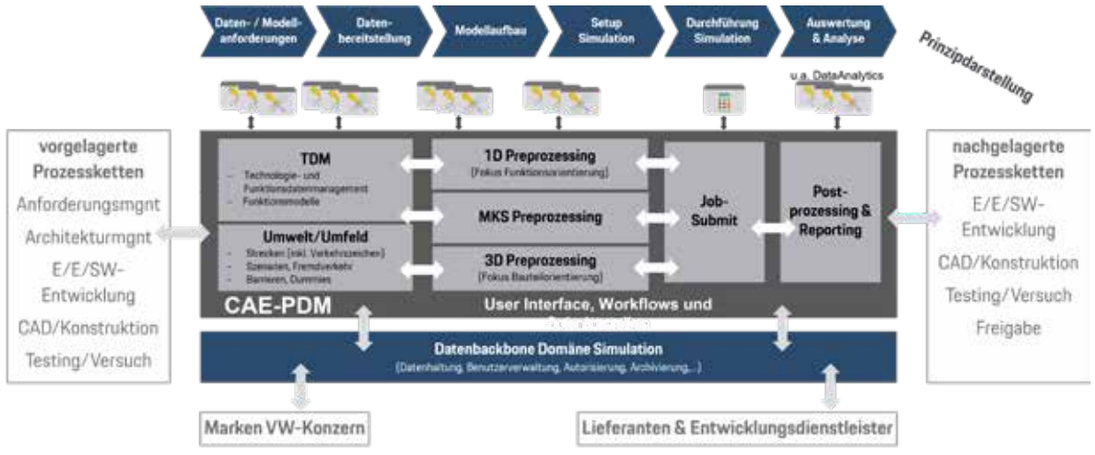
Committed to service

An impressive amount has already been achieved, but there is still need for action, for example in more extensive deployment of the IT system. Of the almost 500 calculation engineers, around 250 have an account in the SPDM system and around 150 use the system almost every day. It was agreed not to make its use mandatory, but to make an 'offer' without engagement for data and process management with comprehensible added value to the calculation engineers. Dirk Ruschmeier puts it in a nutshell: "It is an offer that has to be convincing in terms of functionality and usability."

Background: It is not a question of technology, because the provided SPDM reflects the current state of the art in process support. "Calculation engineers are highly qualified experts who like to carry out adjust-

CAE-PDM as a central, modular data management system for the 'simulation' domain

Source: Ruschmeier / Porsche 2022



ment programming themselves because individual flexibility is very important. That is why the big run for a – harmonizing – SPDM has not materialized to this day. However, the majority of the calculators who use the SimData Manager on a daily basis show that they no longer want to do without this IT support," the PDM strategist clarifies.

New requirements boost SPDM deployment

The wish list for the expansion of Porsche's SPDM system is long. In the future, it should be possible to link the individual calculation runs with the corresponding elements, for example from requirements management, and with physical testing without questions like: Which calculation was used to fulfill which requirement for a specific component or a specific function? Which input data was used in which CAE models? Which model was validated with which physical test? — "Ideally, every CAE discipline should be supported by this end-to-end digital continuity via the SPDM," says the expert, getting to the crux of the matter.

Even more consistency and traceability are just two aspects that will become even more important in the future. Enhanced user experience through role-specific interfaces and functionalities with easy handling of increasingly complex tasks is another. Another important focus of the strategic further development of the SimData Manager at Porsche as part of a multi-year IT and transformation project is the development and expansion of the function-based simulation disciplines. In the future, MKS (multi-body simulation) and 1D disciplines (e. g. for the verification of autonomous driving functions, also known as ADAS: Advanced Driver Assistance System) will be supported along the entire process chain. First pilots with the integration of the MKS tool Adams/Car (Hexagon /MSC.Software) and the ADAS application field of the IPG CarMaker have been started successfully. Next, the management of Matlab Simulink models will be supported by the SPDM. "We are still at the beginning of the capturing of 1D simulations, but the first steps could be completed according to plan," says Mr Ruschmeier with some satisfaction.

Modular and seamlessly integrated

Not only from the perspective of the user, but also from the perspective of the IT that has to run the system, a modular but integrated SPDM is an essential strategic goal Porsche wants to achieve together with PDTec. "The focus is on interchangeability and reuse of modular services on an integrated platform. The idea of a module is also to be open when it comes to the integration of new innovations and to be able to upload individual scopes to new releases independently of the overall system," says Mr Ruschmeier. Here's an example: The 'curve comparison' function, for example, is required for various process steps, such as comparing input parameters in the form of curves or comparing calculation results from multiple simulation runs. So it makes sense to offer this function centrally as a service. Very special department functions, however, should be connected as in-house developments or special tools via an API.

In order to evaluate large amounts of data ('big data') according to any criteria ('data analytics') in the future and to be able to operate and scale this easily through IT, the SPDM will also have to be ported to the cloud. In addition to the numerous challenges, such as the interaction with the local authoring tools and project drives of the CAE engineer, which still have to be mastered, there are also clear advantages, such as access to the SPDM by external partners who work together with Porsche in the area of simulation. "Cloud capability is a central goal in our multi-year IT transformation project and in order to take a data management solution to the next level that meets these requirements, a partnership with PDTec on an equal footing is required," says Mr Ruschmeier, summing up this look behind the scenes of SPDM at Porsche.

Conclusion

Like on the racetrack, perfect teamwork and a high level of flexibility are also important for an SPDM implementation. Porsche and PDTec are not only connected by the geographical proximity of Weissach and Karlsruhe (only some 50 km), but also by striving for first-class performance in data management for the simulation – bound by tradition.

References

(1) Valnion, B. D., „Erfolgsfaktoren der digitalen Fahrzeugentwicklung", CADplus Business+Engineering 1/2004, S. 38–45, Göller, Baden-Baden, Germany

For further information on CAE data and process management visit pdtec.de

Picture: Porsche