Switching over to MSC.ADAMS

Moeller GmbH Employs ADAMS to Maintain Innovative Leadership Status in Switchgear Solutions

"What previously took us half a day can now be done in a couple of minutes"

Customer:
Moeller GmbH, Germany
www.moeller.net

Software:
MSC.ADAMS®

Summary:
Moeller GmbH, a major innovator in switchgear and safety solutions for a wide range of industries, used MSC.ADAMS for studies and calculations in new switchgear development, and to analyze improvements in existing products. Moeller engineers performed various tests on the same virtual model, inlcuding forces and load calculations, resulting in fewer physical prototypes and high-speed recordings. Thanks to MSC. ADAMS, Moeller reduced the development time of new and modified products and improved the quality of existing products.

The international leader in switchgear industry Moeller GmbH has been using MSC.ADAMS for several years. Switching over to MSC.ADAMS was a smart move because it offers many new possibilities for the company to drive innovation in the development process.

The Cradle of Innovation

The Advanced Engineering (AE) development team within Moeller's Industrial Automation group is using MSC. ADAMS for studies and calculations in new switchgear development, as well as analyzing improvements of existing products. As protective devices, all-purpose circuit breakers are widely used in low-voltage power distributions, from small service distribution systems and machine controls up to large power distribution with short-circuit switching capacity to 150kA. A central function of circuit breakers is the detection and control of short circuits and the resulting power shutdown. Reliability in controlling short circuit currents, along with constant loadswitching power, is an essential requirement for these devices. In order to effectively protect machines and engines, the circuit breakers must operate as predicted and therefore must be tested beforehand. Experimental hardware tests of circuit breakers require the building of a realistic prototype including all essential subassemblies and all necessary materials, making these tests laborious, time-consuming and expensive.

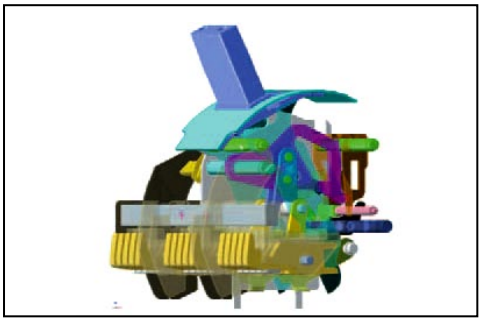
Before using computer-aided engineering (CAE) software, the AE engineers performed motion analyses of their switches using high-speed video recordings of the physical prototype. Static calculations were done manually with functions and loads - a demanding and tedious method, and a major handicap in the field of advanced engineering. Since computer-aided design (CAD) software was already in use at Moeller for switch development, it was a logical step to implement CAE software for functional analysis of the switchgear. Among several software packages, MSC.ADAMS was chosen to be the most suitable for multibody simulation because it enables the engineers to perform a complete analysis of the assembly as well as dynamic calculation of the loads.

Implementing MSC.ADAMS

Moeller engineer Detlef Koch, who is responsible for the field of multibody simulation, carries out analyses with MSC.ADAMS to study the switching behavior of circuit breakers. As a result, his department is experiencing significant progress because the team can use CAD models from the development department for analysis in place of the time-consuming process required for physical prototypes. The engineers build their models either

MSC Software

"Our results are faster and more precise, thanks to MSC.ADAMS."



directly in MSC.ADAMS or use the CAD models as CAD solids coming from Moeller's development department. In MSC.ADAMS, the contact models are easily and rapidly assembled from a set of parasolids and contact elements. Simultaneously, the spring and other forces are applied on the respective parts, causing the model to move. Subsequently, the different movements occurring in a switch process, such as on-and-off switching, can be studied.

In one case, the engineers studied the behavioral effects of changing a relatively large switch from 3- to 4-pole switching. Along with the dynamic calculation of the on-and-off action, 'tripping' behavior under various friction parameters and with welded contacts needed to be studied. Also, forces in the switch setting, such as various 'on' (slow manual switching, fast engine switching) and 'off' switching behavior (standard and with welded contacts), as well as at tripping, had to be determined. Simulations with MSC.ADAMS quickly revealed that there were no problems with on-and-off switching and the device was switching 3-pole as well as 4-pole. The simulation also clarified that the latching mechanism was not as dependent on friction as was presumed before: the breaker mechanism triggered unfailingly at all times. Thanks to the analysis with MSC.ADAMS, Moeller engineers could make essential progress and the development time of new or modified products could be drastically shortened.

Another important element in the testing area of the AE department is the calculation of short circuits.

In order to determine the behavior of the contacts and forces that occur during a short circuit, Moeller developed an in-house software tool. In a first step the magnetic forces affecting the contact system during a short circuit are determined with FEM software. These magnetic forces depend on the opening distance between the contacts. The resulting current- and path-dependent matrix is then imported into MSC.ADAMS.

The voltage of the electric arc which is generated by the contact opening distance affects the flow of the current in the electrical power system. The effects of the electrical arc on the current are then externally calculated and imported into MSC.ADAMS. Finally, the motion can be studied in MSC.ADAMS and the forces affecting the switch determined. Among other things it is possible to study how fast the contacts open on short-circuit conditions, with motions within milliseconds. The faster the contacts open on a short circuit, the lower the conduction interval. This interaction between contacts and electrical arc, and the effect on the electrical power system, can now be examined in the simulation process with the above mentioned in-house product and easily integrated into the simulation process. Due to the open architecture of MSC.ADAMS, it is easy to generate customer-specific subroutines and to produce tailor-made simulations.

Comprehensive Parameter Studies

When modifying only some individual parameters, tests with hardware models of switches can still be done. However, a recently performed parameter study required 17 calculations of the model. "Such a study would not have been possible with models which we would have had to build," Koch explains. "With MSC.ADAMS 2003 we can describe the models much faster and carry out variant calculations. We are also able to study the models in detail, and additionally control friction parameters, vary spring forces, perform various tests on the same virtual model, and much more." The results of these variant calculations are fully implemented in the conceptual phase of switch design and thus allow for landmark decisions right from the start.

Better Products in Less Time

Performing ground-breaking analyses in the concept phase pays off in many ways. The use of MSC.ADAMS results in improved product performance because a much larger number of variants can be studied. "By using MSC.ADAMS, higher demands could be realized and the overall quality of the product could be improved. Our results are more accurate and a lot faster," Koch states. Additionally, the MSC.ADAMS postprocessor offers significant plots and animations, which quickly reveal the right development direction. "With our precise results, management can come to their decisions more quickly and with more confidence," Koch says. "This is a big time and cost factor."

On top of all this, the use of simulation saves a lot of money. "Our numerous studies in testing plants cost a fortune, because the manufacturing of the models is extremely laborious and expensive", Koch notes. "However, since we introduced MSC.ADAMS to calculate the virtual models, the number of hardware prototypes has been significantly reduced." Hardware prototypes are now mainly used to check the accuracy of the calculations. The results speak for themselves: calculation and test showed a very good match. "Starting off, we were happy to reach an accuracy with a tolerance of 20%," Koch states. "Since we implemented MSC.ADAMS, our quality statements for release time show a tolerance below 5%."

The Three-Minute Study

For the Advanced Engineering team, MSC.ADAMS 2003 is a major step forward, evidenced by tangible time savings. In the past, a parameter study with 17 variants required a half-day for one calculation run - now with MSC.ADAMS 2003 these comprehensive calculations can be completed in a much shorter time frame. "The new version MSC.ADAMS 2003 is a clear success. What previously took us half a day can now be done in a couple of minutes!" Koch claims. This immense leap in time saved enables the Moeller engineers to make use of even more MSC.ADAMS capabilities. "This improvement in the calculation time gives us the time and room for yet more complex calculations, thus we can refine the models and test them more deeply," Koch adds.

The department is very much involved in the development process of the powerswitches. In order to get new switches to market faster, design decisions must be made very early. Simulation software allows Koch's team to meet the demands of faster and more accurate results. He says, "Our parameter studies with MSC.ADAMS differ very much from our usual method. Our results are faster and more precise, thanks to MSC.ADAMS."

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