

Turn It On, the Right Way!

Usage of RecurDyn with Multi- Flexible Body Dynamics (MFBD) at Siemens E&A

As a product supplier and systems integrator, Siemens Energy & Automation provides products, services and solutions to energy providers and industrial clients needing reliable and cost-effective electrical service from the mid-voltage transformer to the consumer. Since 2004, the Advanced Development Department of Siemens has used RecurDyn for the development and optimization of circuit breaker mechanisms.

In the development of low-voltage switches promising new concepts are compiled and the relative performance assessed using simulation and testing. To accelerate the new development of the mechanical switching devices a lot of virtual testing is done with the help of different simulation tools.

“Advanced development and simulation are closely tied together,” says Dr. Michael Anheuser, Director of Advanced Development and Simulation at Siemens Automation and Drives, Low-Voltage Controls and Distribution. “We utilize various tools, from simple Excel macros of bending formulas to complex CAE programs. The greatest benefits of RecurDyn simulation for us in Advanced Development are in the areas of model generation, development and evaluation.”

Dr. Anheuser’s development team aggressively uses simulation tools for magnetic field investigations, multi-body simulation, the structural analysis and electrical current calculations. In addition, system simulation methods enable engineers to evaluate how well different

subsystems work together to achieve the overall objectives of a circuit breaker.

Thus new product concepts can be quickly evaluated for future developments projects with respect to potential performance, risk and feasibility as well as robustness.

The Siemens Advanced Development department is responsible for the development and optimization of circuit breakers. Since 2004 Siemens has provided the RecurDyn simulation software in this department to help design the complicated kinematic assemblies that are required.

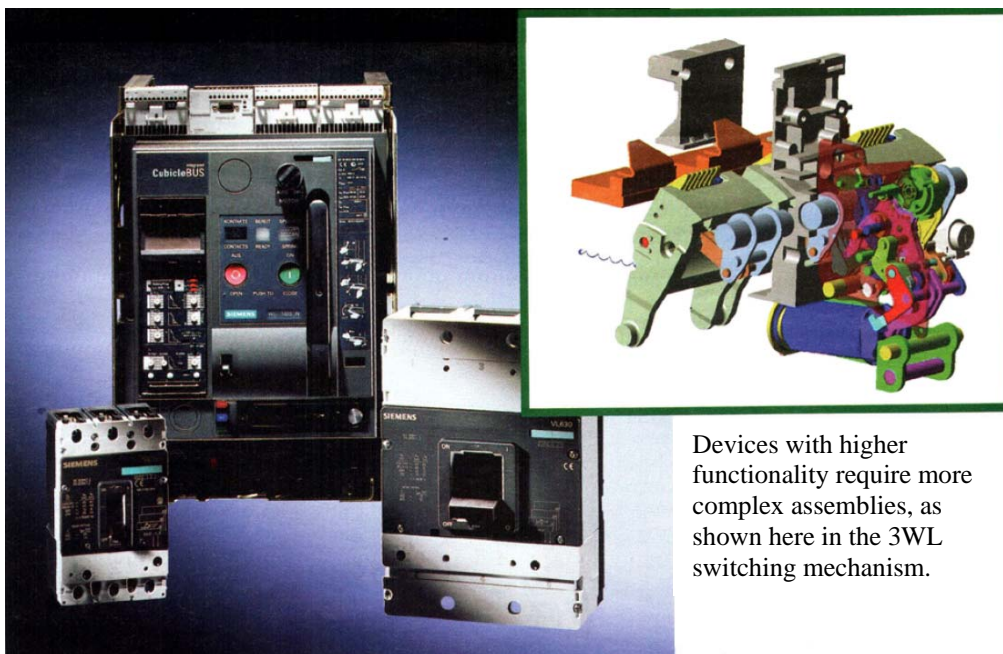
With RecurDyn’s help Siemens engineers can investigate the highly-dynamic motion of breakers in a timely, goal-oriented manner without resorting to physical prototypes. In particular, the RecurDyn/ Full-Flexibility module is used to perform a combination of multi-body and finite-element analysis, known as multi-flexible body dynamics, or MFBD. “RecurDyn is THE tool for combined, MFBD analysis,” confirms Dr. Anheuser.

From product concept to realization - stay on the right track with virtual prototyping

In the search of a long-term multi-body system tool that could address the tasks specific to Siemens, both long-established software as well as new software products were considered.

“In the end the choice was narrowed to RecurDyn and two other multi-body system tools, and all three tools were tested in detail,” explains Dr. Anheuser.

RecurDyn was also evaluated as part of the graduate studies of current Siemens employee Johannes Greiner. It



The offer:
Product overview of
the Siemens circuit
breaker.

Devices with higher functionality require more complex assemblies, as shown here in the 3WL switching mechanism.

was quickly determined that RecurDyn was well-suited for the target application due to its extensive simulation capabilities, quick solver, user-friendliness and adaptable methods of model construction.

“RecurDyn was clearly the best tool for our application. In addition, we found that FunctionBay provided very good technical support. The employees of the software supplier reacted quickly and flexibly to our inquiries and we were able to perform substantial work with their support,” stresses Dr. Anheuser.

The virtual models of locking switches and circuit breakers are first defined by Siemens using their CAD tools, and the geometry is then directly transferred to their selected CAE tools such as RecurDyn. In this way the complex behavior of new concepts can be examined to investigate how changes in certain locking parameters affect the switching behavior.

“Thanks to simulation we quickly found out that two of the model parameters could greatly influence the overall tolerance chain of the circuit mechanism. By changing several parameters, we could determine the optimum configuration and identify the critical areas thereby avoiding problems in the assembly design.

“Identification of the critical design variables is important for the development of an optimum switch, because once the switch is manufactured, normal tolerances may cause the product to operate outside ‘target’ values,” explains Johannes Greiner, development engineer with Siemens. Even though the responsibility for new developments lies with the Advanced Development department, interaction with the design and other departments is critical in making changes to improve existing switches. For example, simulation models rely on geometry from CAD tools and efficient loading of the geometry speeds up the design process.

Thanks to simulation a new product idea can be quickly compared to current devices and any undesirable characteristics can be quickly identified. The influence of the tolerances of the locking pin on the closing performance of the circuit breaker can be analyzed.

It can be quickly determined that with given tolerances of the locking pin that the 4-pole switch has enough reserve energy to bring the switch mechanism to its final position, therefore achieving full performance.

In addition, the RecurDyn MFBD Toolkit, which couples the analysis of structural behavior of flexible components and the overall multi-body system, has the capability to analyze the influence of specific components, such as the locking pin, on the timing and robustness of the switch.

Return on Investment - Simulation pays for itself through material savings up to 50%

In the development process the engineers must develop new concepts that are creative, and technically advanced, yet feasible, while considering new materials, technologies, interface requirements, and customer.

User Feedback

Johannes Greiner, development engineer with Siemens A&D: “By using RecurDyn in the development of circuit breakers, we not only achieved improved product quality but also time savings thanks to RecurDyn’s user friendliness.”

Dr. Michael Anheuser, Director of Advanced Development and Simulation with Siemens A&D: “We expect advanced software tools to be 100% reliable and robust. RecurDyn meets our high expectations; therefore we plan to increase our reliance on RecurDyn to handle all of our multi-body simulation needs.”

QUICK INFO

“To implement new ideas we cannot rely on past years’ experience or fall back on the designs of products in production. We rely on simulation to quickly portray the interactions within the assembly and to make the right development decisions,” according to Dr. Anheuser.

“Our purpose is model our concepts such that we can understand and optimize the costs and performance of our products. Thanks to simulation we can examine many different product concepts attempts at an early development stage and have feedback on product performance before building physical prototypes. Thus we can decide which concept is the best for our new product early in our design process,” explains Dr. Anheuser. “This upfront simulation leads to a considerable reduction of development iterations and offers therefore increasing profits. In the worst case the need for an extra iteration can delay our development process by approximately six months, because each change in our product requires careful study to assess the complex interfaces and interactions between the various subsystems in the product. With the use of simulation we save not only time, but also material costs. We can cite a number of examples where we have achieved up to 50% savings on the cost of materials with the use of simulation tools. The calculation of loads in the virtual model that is done by multi-body simulation helps structural analysis groups save time & material, and to control costs. We would like to pursue this further in the future by using the RecurDyn MFBD Toolkit to simulate the flexible components in the assembly that operate in highly dynamic conditions, in order to further optimize our products,” says Dr. Anheuser.

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