



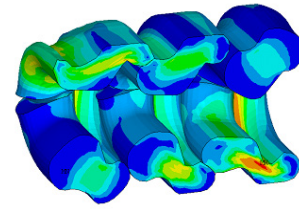
+ Voith Turbo Scharfenberg

The Scharfenberg coupler is one of the most important and successful coupling systems for rail travel. Voith Turbo Scharfenberg keep its leading position in the industry through intensive development and continuous enhancement of these systems. ANSYS technology supports our ability to keep high quality standards while streamlining our development process to underline our market leadership in safe and reliable railcar couplers.

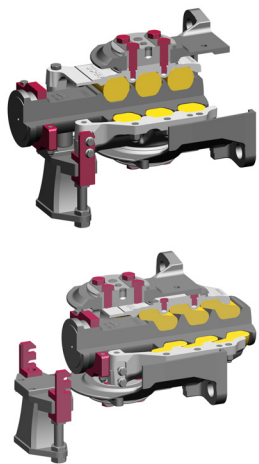
Eckart Jäde

*Team Leader Technical Calculation
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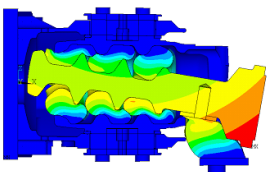
ANSYS enables an industry leader to design railcar couplers, streamlining design while meeting safety and regulatory requirements.



Strain distribution within the rubber elements under a combined load of compression and rotation



Energy-absorbing components protect the rail vehicle and passengers during normal operation and in case of an impact.



The energy-absorbing rubber elements are highly deformed by the enormous forces of an impact.

To mitigate the impact that a train collision can cause to passengers, modern railway safety requires railcars to absorb the enormous energy created by the crash. Some cars are designed to absorb the collision energy using several parts that all work together, but the majority of the energy can be absorbed directly at the coupler. Some coupling elements absorb this energy directly; in other cases, additional elements can be combined with the coupler to significantly improve the passive safety of railcars and trains.

Challenges

These energy absorption systems are required to meet specific standards. A design assessment based on simulation of different collision scenarios allows engineers to optimize the coupler and its energy absorption characteristics. However, energy absorption is not only required for heavy impacts; even smooth train operation or minor impacts require energy absorbing components. Components in the example represent the first stage of the absorption system and are followed by higher degrees of protection. The rubber used in the elements undergoes large deformation during a collision, making simulation of these hyperelastic materials a challenge. In addition, specific nonlinear force-path characteristics of the absorption elements must be met.

Technology Used

ANSYS® Mechanical™

Engineering Solution

- ANSYS standard contact formulations in ANSYS Mechanical software are used to model the complex contact behavior between the casing and absorption elements as well as the contact between the rubber elements.
- A characteristic force-path curve of test results is used to adjust the hyperelastic material behavior.
- Multiple load scenarios are analyzed to provide

enough load combinations to adequately assess the design.

Benefits

- ANSYS Mechanical allows a simple and fast setup of highly nonlinear analyses within ANSYS Workbench™ to streamline the development process.
- Hyperelastic materials within ANSYS Workbench can be used in the ANSYS Mechanical simulation.
- Standard contact setting can be employed without convergence issues.
- Using engineering simulation helps Voith Turbo Scharfenberg maintain market leadership, reduce time to market, and decrease warranty costs while meeting safety regulations.

Company Description

For more than a century Voith Turbo Scharfenberg has been associated with quality and safety. Continuous technical refinements and updated technology have made the “Schaku” one of the most prominent railway coupler systems worldwide. More than 500 000 couplers in use, from light rail vehicles to high speed trains, show the high degree of trust customers have in Scharfenberg products.

Today, Voith Turbo Scharfenberg system solutions cover the whole range of energy absorbing components for train front ends, including kinematics and control electronics. From light rail, monorail or metro vehicles, regional transport to high speed trains, the company’s products are suited for any application and perfect for their purpose. In the best Scharfenberg tradition the company is always one step ahead of the times — with eyes firmly on the safety of passengers and trains.

Simulation at Voith Turbo Scharfenberg is supported by ANSYS channel partner CADFEM GmbH.

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