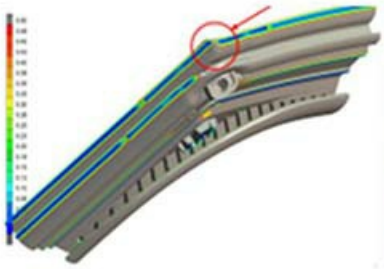
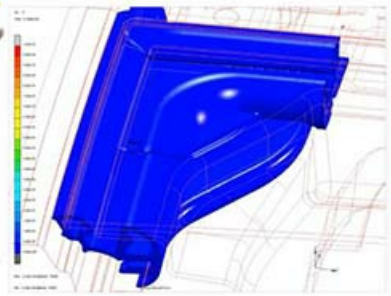
# VIRTUAL SIMULATIONS AND TECHNIQUES OF ADVANCING SEALING SYSTEMS





Highly engineered automotive sealing systems are crucial components in all vehicles, providing a barrier between the outside environment (water, dust, debris, and environmental factors such as wind and road noise) and vehicle occupants. While vehicle sealing systems have always been highly engineered, the fast-paced shift to battery electric vehicles is driving even higher complexity and attention to detail. With the elimination of internal combustion engines, noise that was once drowned out is much more noticeable in the vehicle. Sealing systems are being called upon more often to help reduce the increased noise perception while also focusing on weight reduction and aerodynamics to help increase vehicle range. Cooper Standard is strategically integrating digital tools and advanced analytics to ensure our sealing solutions meet and exceed engineering and performance requirements, while delivering exceptional value to our customers.

**Design by Analysis**

Cooper Standard is a leading expert in computer-aided engineering (CAE) and digital simulation for advanced engineered sealing solutions, and one of the first suppliers to receive CAE certification with one of our major customers. When designing sealing systems with CAE tools, our engineers simulate various conditions before any physical prototypes or tests are created. This allows for faster development cycles and more accurate models that represent real-world scenarios. Our team of experts leverage these digital tools to consistently deliver optimized quality solutions to exceed our customer's needs. As an example, molded detail analysis is very complex, containing millions of elements and multiple contact bodies. This type of analysis used to take weeks if not months to complete. With ever compressed program timing, by the time the analysis was finalized, tools had already been kicked off and required expensive changes. Our talented CAE team was able to dramatically improve this process, allowing analysis to be completed in days instead of weeks, which enables engineers to evaluate problem areas and resolve them prior to tooling kick off.

**Virtual Validation**

Virtual validation involves simulating product performance through digital models rather than physical testing. Cooper Standard experts create detailed models of our products and test options which are then validated through simulation of many different scenarios in a relatively short amount of time. This process provides for much faster turnaround time with more accurate results than traditional lab testing methods or time-consuming field tests. Simulations can be completed multiple times with different variables, such as varying seal gaps, tolerance stacks to mating components, and changing environmental conditions, allowing engineers to evaluate various options before finalizing a design. This analysis helps elevate confidence in the selected design and can also help reduce cost and waste associated with traditional physical testing, avoiding redundant trials and producing fewer prototypes. Other sustainability benefits include reduced greenhouse gas emissions, less water consumption and energy savings.

Overall, Cooper Standard's analysis aids customers in selecting the optimal system solution by reconciling diverse needs with data-driven insights. This enhancement saves time, increases product quality and positively impacts sustainability.

Learn more under the *Advanced Analytics and Digital Tools* on CooperStandard.com or Contact Us to learn more about virtual validation.

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