

DuPont Performance Polymers

COMPUTER AIDED ENGINEERING

The Science Behind Computer Simulation Engineering for the Automotive Industry

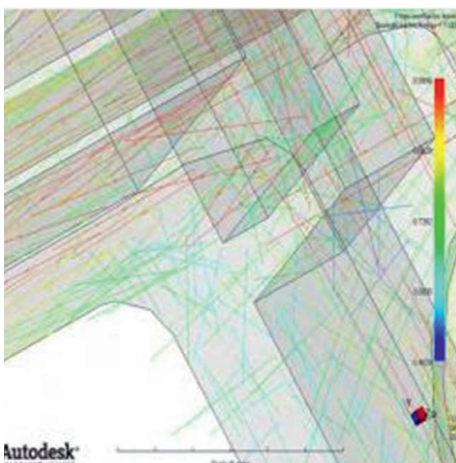
The Global Collaboratory

DuPont's network of global Innovation Centers offers a new approach to innovation and collaboration. The network is designed to give life to ideas by allowing customers, governments, NGOs, universities, and other strategic partners to collaborate to solve both regional and global issues.

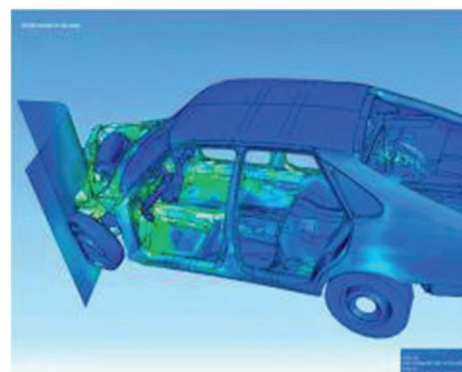
Innovation Centers speed ideas to market by boosting the problem-solving power of private/public alliances, acting as catalysts for growth, and allowing precision in the analysis of societal needs and consumer aspirations juxtaposed with real-time performance data. Results include measurable efficiencies in time and cost, dramatic product enhancements, and enhanced lifestyle options for people around the world.

Through the Innovation Centers, collaboration partners can connect with a network of more than 9,500 scientists and engineers across the globe located in over 150 research laboratories and application development centers to find answers to critical challenges. This connection between scientists, engineers, mathematicians, and top industry experts enables identification of local needs, anticipation of market trends, and the rapid development of innovative solutions.

Automotive safety conjures images of scientists with white coats and clipboards crashing vehicles in a test lab and recording catastrophic-looking results. For many years, that was the best method to test a vehicle's reliability and safety. It was also an extremely expensive and time-consuming testing procedure. The trial and error process of "crash it, fix it, then crash it again" lead to 4 ½-year average development cycles for vehicles. Today, with the help of highly sophisticated engineering materials, computer-aided materials modeling, research and testing, the average new vehicle development process has been reduced to 18 months.^[1]



At DuPont, the advent of high-powered computing combined with state-of-the-art materials and highly qualified design experts has taken computer-aided simulation engineering to a new level for their value-chain partners. Simulations closely replicate real-world scenarios, resulting in quick, innovative solutions. This elevated level of expertise enables engineers and designers to reduce the need for trial and error and minimize lengthy and costly design iterations and design cycle time.



General Motors reports accrued savings of \$350,000 for each crash test avoided by using computer simulations to generate crash test data for use in the design of safer vehicles.^[2] According to Albert Ware, Director of GM's Vehicle Safety and Crashworthiness Laboratory, crash testing "used to be hardware-driven, now it is math-driven."^[3]

From Art to Part

The automotive industry ceaselessly seeks materials that will help them reduce vehicle production time, total system costs and environmental impact. To meet these critical targets, automakers collaborate with DuPont for expertise in materials, design and processing technologies from the earliest stages of development until the finished vehicle rolls off the manufacturer's assembly line.



Using computer-aided engineering (CAE) technologies to optimize material selection and testing and enhance manufacturing methods, new materials and formulations are developed to meet the needs of the automotive industry as manufacturers strive to improve performance and productivity.

By listening closely to the needs of their value-chain partners, DuPont has increased the depth and breadth of their materials development and application capabilities. DuPont's Performance Polymers (DPP) division teamed up with the DuPont Engineering Research and Technology (DuET) to enhance their fundamental materials science with added resources, capabilities and expertise. State-of-the-art advanced computer modeling and simulation have been pivotal in the evolution of advanced performance materials that meet new needs of the auto original equipment manufacturers (OEMs). Advanced material models are developed to run highly sophisticated finite element

analysis (FEA), providing material designs data and part performance analysis, and minimizing prototyping

The growth of computer-simulated design technology, also known as predictive engineering, has exploded in recent years. Faster computers and advances in software technologies have reduced data processing time by 80%. Millions of data points are gathered from materials during every second of a crash test, providing critical information for materials modeling, verification and analysis.

Throughout the entire process, from "art to part," DuPont's design and engineering team share data and analysis with their collaboration partners using commercially available CAE software suites in a non-proprietary, transparent environment. This transparency provides a true collaborative connection between DuPont and their value-chain partners, with real-time information available at all stages of design and development.

[1] (Halvorson, 2010)
[2] (Seetharaman, 2013)
[3] (Halvorson, 2010)

What is Finite Element Analysis?

Finite element analysis (FEA) is a computerized method for predicting how a product reacts to real-world forces, vibration, heat, fluid flow, and other physical effects. Finite element analysis shows whether a product will break, wear out, or work the way it was designed. In the product development process, it is a forward-looking analysis, predicting what is going to happen when the product is used.

FEA works by breaking down a real object into a large number (thousands to hundreds of thousands) of finite elements, such as little cubes. Mathematical equations help predict the behavior of each element. A computer then adds up all the individual behaviors to predict the behavior of the actual object. Source: (USA Autodesk)

Plastics, Polymers & Resins

DuPont is committed to discovering and developing lighter-weight alternatives to metal – materials that can withstand the intense heat, the aggressive chemicals, and the high pressures in constant play within automotive engines. Plastics, polymers and resins offer lightweight yet structurally sophisticated material solutions reducing the overall weight of the vehicle and enhancing its sustainability profile:

- While plastic comprises 50% of automobile material composition, it accounts for only 8-10% of the vehicle's total weight.
- Lighter cars are more fuel-efficient. Independent studies have found that a 10% reduction in vehicle weight reduces fuel consumption by 5%.
- Moldable and formed plastics have given designers the ability to design aerodynamic body panels which reduce wind turbulence, increasing fuel mileage and enhancing passenger comfort.
- Plastics are critical to the development of new automotive green technologies such as electric vehicles and hydrogen fuel cell powered autos.

As a result, automobile designers are able to reduce vehicle weight while also reducing cost and improving safety, vehicle performance, and fuel efficiency, ultimately delivering greater value to their customers.

Source: (American Chemistry Council, 2009)

To find out more, visit plastics.dupont.com or contact the nearest DuPont location.



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