

Enhancing tire performance with MSC solutions

Tires are complex reinforced structures absorbing shock while providing traction under multiple weather and driving conditions, including on-road and off-road, under dry, wet, snow and icy conditions. The aircraft tires pose additional challenges with the need to bear high impact loads, and heat and wear generated during landing. The broad range of loading and environmental factors need to be considered in design and development of tires, as sudden failures can have catastrophic consequences.

MSC Software provides a complete solution to tire design and development, helping companies shorten the development cycle, while keeping the costs down. This is achieved by addressing the tire design problem from multiple fronts with superior simulation solutions, automation methods to improve efficiency, and simulation process and data management.

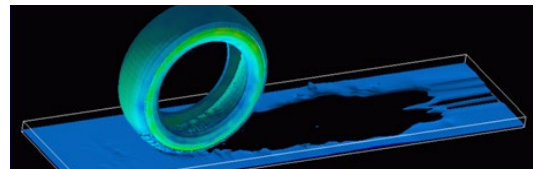
Simulation technology:

MSC technology provides solutions to simulate the events experienced by the tires throughout their life. By modeling events from manufacturing to wear and failure, engineering teams can gain insights into new designs earlier in the development process, helping reduce the cost of design modifications.

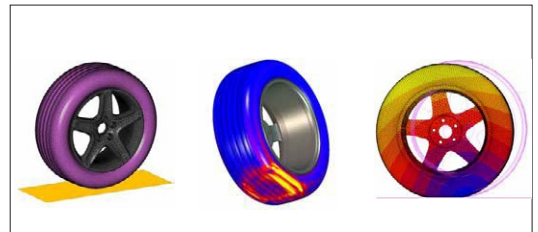
- Choose from a wide selection of material models (e.g. hyperelastic, nonlinear elastic, isotropic, orthotropic and anisotropic, composite, plastic, user defined)
- Model with elements that are expressly designed to address nonlinear deformations and reinforcements
- Investigate and optimize curing process parameters to ensure high quality products
- Simulate the loading conditions experienced throughout the life of a tire, including
 - Rim mounting
 - Inflation
 - Vertical loading
 - Steady state rolling
 - Transient rolling
 - Cornering



Hydroplaning



Hydroplaning

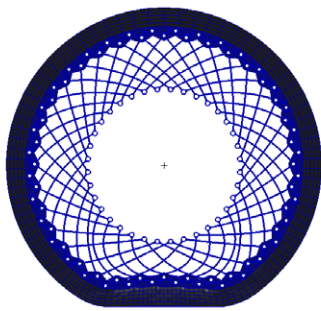


Tire road contact



Curb impact

- Roll-stability events (embankment, sand-bend, corkscrew)
- Braking
- Hydroplaning
- Impact (curb strike, speed bump)
- Easily set up and simulate contact conditions like tire-rim contact, footprint analysis and self-contact
- Perform static, modal, frequency response, transient dynamic and coupled thermomechanical analyses
- Analyze the effects of friction (static and dynamic, orthotropic) on tire behavior and wear
- Explore new designs in pneumatic and non-pneumatic tires with easy modeling techniques and customizable methods
- Analyze tire performance during aircraft landing (impact, wear, heating)
- Study the effects of tires on vibration and acoustic behavior of the vehicle
- Conduct system level simulations to investigate the response of the complete vehicle under various driving conditions and maneuvers
- Perform durability studies by computing realistic tire-road interaction forces, using realistic road models
- Use Design of Experiments to investigate multiple solutions and identify the best one
- Gain insights into the tire and vehicle performance on various soil/ground conditions



Non-pneumatic tire with composite springs

Automation:

While the core components of an automotive tire may remain constant, their size, layout, and configuration varies, which requires additional testing. MSC's customizable solutions can be used to automate the tasks of model creation, saving time and increasing productivity.

- Perform design variation studies to identify the best possible solution
- Accelerate model creation and analysis
- Reduce human error and automate repetitive tasks

Engineering lifecycle management

Increased use of simulation results in numerous files that need to be tracked and managed. While automation may ease the model creation and post-processing steps, the related scripts can remain stored in various locations and uncontrolled. With each new release of the applications, the scripts may need to be updated, which can be hard if they cannot be tracked.

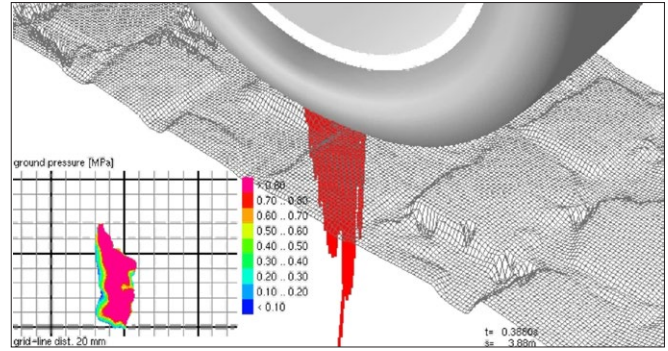
MSC Software is a leader in Engineering Lifecycle Management with a solution focused on CAE process and data management, addressing the challenges unique to product development and engineering departments.

- Capture local disparate data in a central, searchable environment
- Author and manage repeatable simulation work activities
- Assemble models and load cases from one to thousands of simulations
- Launch simulations to the High-Performance Computing (HPC) environment
- Sort through terabytes of data to get the most meaningful design insight automatically
- Report and compare virtual-to-virtual or virtual-to-physical test results in an automatically generated company specific report
- Trace the entire simulation pedigree from model to report

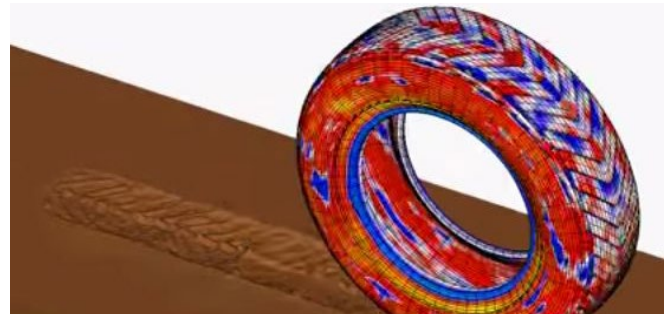
Engineering services

If you want results you can trust and the flexibility of working with extremely skilled engineers who know FEA and how it's applied to engineering problems like yours, MSC is a team you can rely on to improve your product development process with the ability provide consulting support based on your specific needs and requirements. MSC Software supports services engagements in any of the following manners.

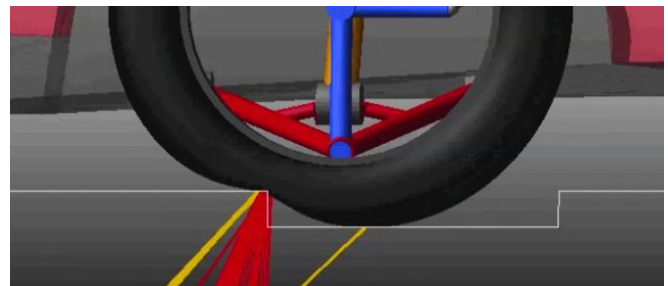
- Mentoring, on site or over the web
- On-site support
- Staff augmentation
- Simulation projects
- Customization and process automation
- Methods development
- Knowledge transfer
- Simulation Data and Process Management



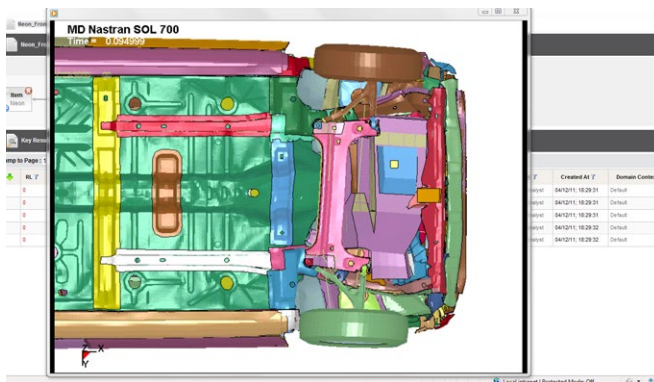
Rough road modeling



Tire on soft ground



Tire performance with pothole impact



Browser based environment for simulation process and data management



Replication of four poster test



Hexagon is a global leader in sensor, software and autonomous solutions. We are putting data to work to boost efficiency, productivity, and quality across industrial, manufacturing, infrastructure, safety, and mobility applications.

Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

MSC Software, part of Hexagon's Manufacturing Intelligence division, is one of the ten original software companies and a global leader in helping product manufacturers to advance their engineering methods with simulation software and services. Learn more at [mscsoftware.com](https://www.mscsoftware.com). Hexagon's Manufacturing Intelligence division provides solutions that utilise data from design and engineering, production and metrology to make manufacturing smarter.

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