



Increasing Fuel Economy Through Better Tire Design

ENERGY
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Transportation FOR THE 21ST CENTURY

Background

Approximately 4-7% of a car's fuel consumption is spent overcoming the tires' rolling resistance (the energy lost from the tires rolling against the road). Developing high-efficiency tires that minimize rolling resistance while maintaining traction, handling, and durability would contribute to the higher fuel economy goals promoted by the Partnership for a New Generation of Vehicles (PNGV) Program.

The Technology

Advanced computational tools, like finite element analysis (FEA), were applied in designing tires to isolate regions where energy losses are greatest due to rolling resistance. The results of these analyses will be useful in developing new tire designs with features such as special tread patterns, lighter yet stronger materials, reduced sidewalls (to minimize flexing), and higher pressure. The computational tools have been calibrated against actual tire performance and incorporate a broader range of physical effects than previously evaluated, resulting in increased modeling accuracy. This higher level of accuracy helps streamline tire model development, enabling faster design solutions and production. By using these advanced modeling tools, tire manufacturers are able to target

specific tire regions that can be redesigned to lower rolling resistance. Designs can simultaneously lower rolling resistance to improve fuel economy, while maintaining key tire performance characteristics. Tire manufacturers can use the results of the computational tools to reduce or eliminate the expense of building and testing multiple prototype tires.

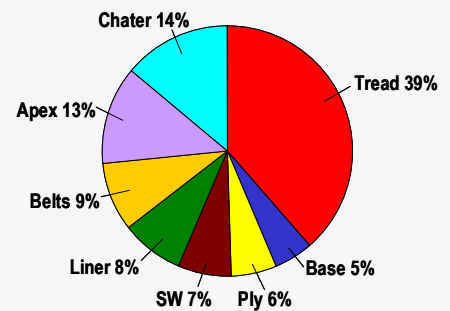
Commercialization

The Goodyear Tire and Rubber Company has incorporated the codes from the computational modeling tools into its production line processes. Use of the computational tools has contributed to an average reduction in tire rolling resistance for all U.S. consumer vehicles on Goodyear tires of approximately 3-5 percent over the past three years.

Analyzing tire rolling resistance is part of a larger suite of analyses for evaluating tire wear and resistance that have been performed under a Cooperative Research and Development Agreement (CRADA) between Sandia National Laboratories and Goodyear since 1993. This program will continue with the ultimate objective of making advanced computational modeling tools a routine part of the tire manufacturing process.

Benefits

- Specific tire regions can be targeted for redesign
- Design changes to improve fuel economy will not affect tire performance
- Minimizes the need to build multiple prototype tires
- Annual fuel savings of 80 million gallons



Energy loss by tire region.

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