Optimization Process for Agricultural and Commercial Vehicles Steel Wheels

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Agenda

- Business
- Development Cycle
- Input
- Validation
- FEA x Test
- Finite Element Optimization
- Results
Largest Manufacturer of Original Equipment Passenger Car, Commercial Vehicle and Off-Road Wheels in the World

Passenger Car Steel and Aluminum Wheels

Commercial Vehicle Steel and Aluminum Wheels

Agricultural / Off-Road Steel Wheels
Development Cycle

Design → Prototype → Validation → Production

Common Process
Development Cycle

Design → Prototype → Validation → Production

FEA Process
Development Cycle

Design → Prototype → Validation → Production

Design → FEA → Prototype → Validation → Production

FEA Optimization → Design → Prototype → Validation → Production

FEA Optimization Process
Development Cycle

Common Process:
- Design → Prototype → Validation → Production
- Design → Prototype → Validation → Production
- Design → Prototype → Validation → Production

FEA Process:
- Design → FEA → Prototype → Validation → Production
- Design → FEA → Prototype → Validation → Production
- Design → FEA → Prototype → Validation → Production

FEA Optimization Process:
- FEA Optimization → Design → Prototype → Validation → Production
- FEA Optimization → Design → Prototype → Validation → Production
- FEA Optimization → Design → Prototype → Validation → Production
Definitions:
1- Tire
2- Hub Contour (Caliper)
3- Assembly Dimensions
4- Load Capacity
5- Optimizable Domain
Finite Element Optimization

Topology

Shape (Profile)

Shape (Ventilation)
There was a reduction of -27% at stress level.
There was an increase of +20% at the wheel load capacity.
There was a reduction of -12% at stress level.
There was an increase of +50% at the wheel load capacity.
There was a reduction of **-10%** at stress level.

There was a reduction of **-7% (2.6lbs)** per wheel.
There was a reduction of -9% at stress level.

There was a reduction of -5% (3.7lbs) per wheel.
Weight Reduction for CV Steel Wheels

**Results**

**SA & Europe**
- GEN 0: 90 lbs
- GEN 1: 84 lbs
- GEN35: 77 lbs
- GEN34: 75 lbs
- GEN30: 66 lbs

22.5 x 9.0 (8820 lbs)

**NA**
- 68 lbs
- 66 lbs
- 64 lbs

22.5 x 8.25 (7400 lbs)

**Green House**

Aerodynamics Wheel Cover

2010 2014 2019 2020 2022 ...
Results

1. Design → Prototype → Validation → Production
2. Design → FEA → Prototype → Validation → Production
3. FEA Optimization → Design → Prototype → Validation → Production

Average Time Reduction

-26% Time-to-Market
+30% Fatigue Life
-12% Weight
Thank you!
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