Simulation Cuts Yearly Material Costs by $1.2 Million

Whirlpool Corporation SA

Consumer Products

Brazil

www.whirlpoolcorp.com

ANSYS® Mechanical™

Overview

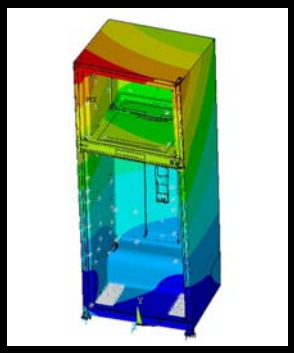
Global competition in the appliance industry is placing ever-increasing pressure on manufacturers to decrease costs while maintaining high quality.

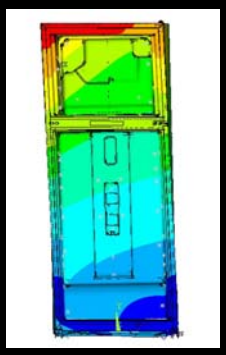
When Whirlpool Corporation looked to cut costs associated with producing a three-year-old, 450-liter double-door refrigerator, it needed to continue to meet the specific cabinet deflection and door drop limits of its current design; it also needed to maintain adequate cabinet stiffness. Cabinet deflection and door drop occur when a fully loaded door is opened: The cabinet distorts and the door moves downward, which eventually leads to increasing cabinet deformity. Additionally, any redesign that changed cabinet stiffness could negatively impact insulating capabilities and esthetics, which influence consumer-perceived quality.

Testimonial

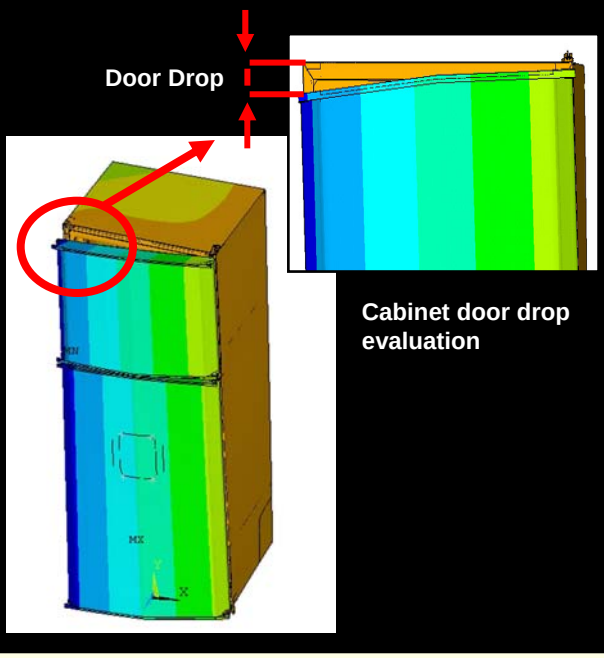
“By using ANSYS Mechanical software and Six Sigma tools, analysts are given the ability to develop complex finite element cabinet models calibrated with real data, enabling the optimization of first-round physical prototypes. This procedure reduces development time and cost while meeting market requirements.”

Axel J. Ramm
Development Specialist – Black Belt
Whirlpool Corporation





Cabinet distortion due to door loading



Cabinet door drop evaluation

Challenges

- Use Six Sigma tools to assess manufacturing process and laboratory test sources of variation
- Reduce variation to accomplish finite element model calibration
- Optimize design to reduce sheet metal material costs while maintaining product performance and quality
- Explore sequential strategy based on Design of Experiments and sub-problem approximation
- Overcome difficulty in accurately evaluating cabinet deflection or door drop due to influence of variation sources

Solution

- Employ ANSYS Mechanical to evaluate design factors that affect door drop, cabinet deflection and, ultimately, product performance, including:
  - Mass thickness of various components
  - Manufacturing process variation
- Use sequential analysis to achieve cabinet structure optimization

Benefits

- Maintained quality standards by meeting specific cabinet deflection and door drop limits
- Achieved mass optimization via an adaptation that reduced overall cabinet mass by 26 percent while maintaining door drop and cabinet displacement to reasonable levels
- Reduced material costs by 15 percent per product
- Reduced yearly costs by $1.2 million