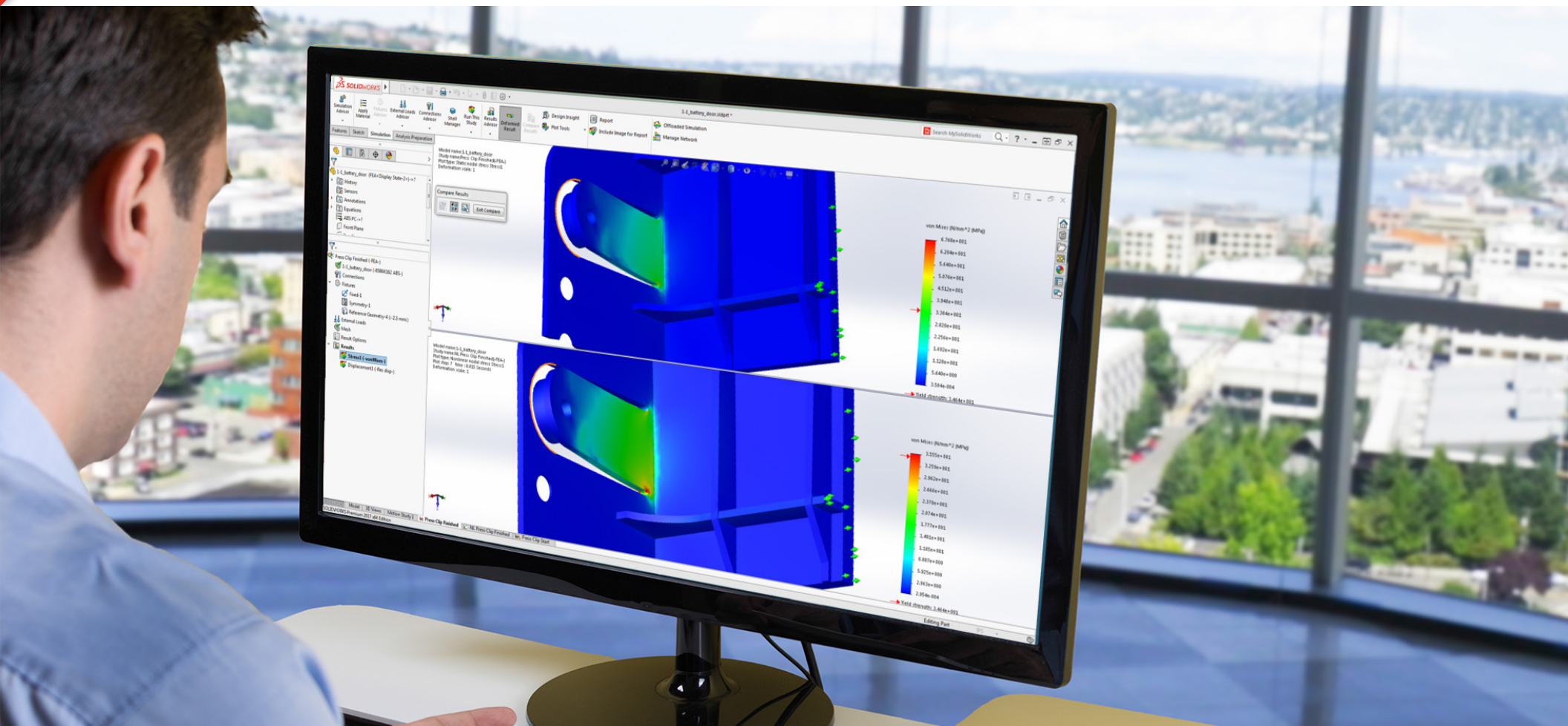
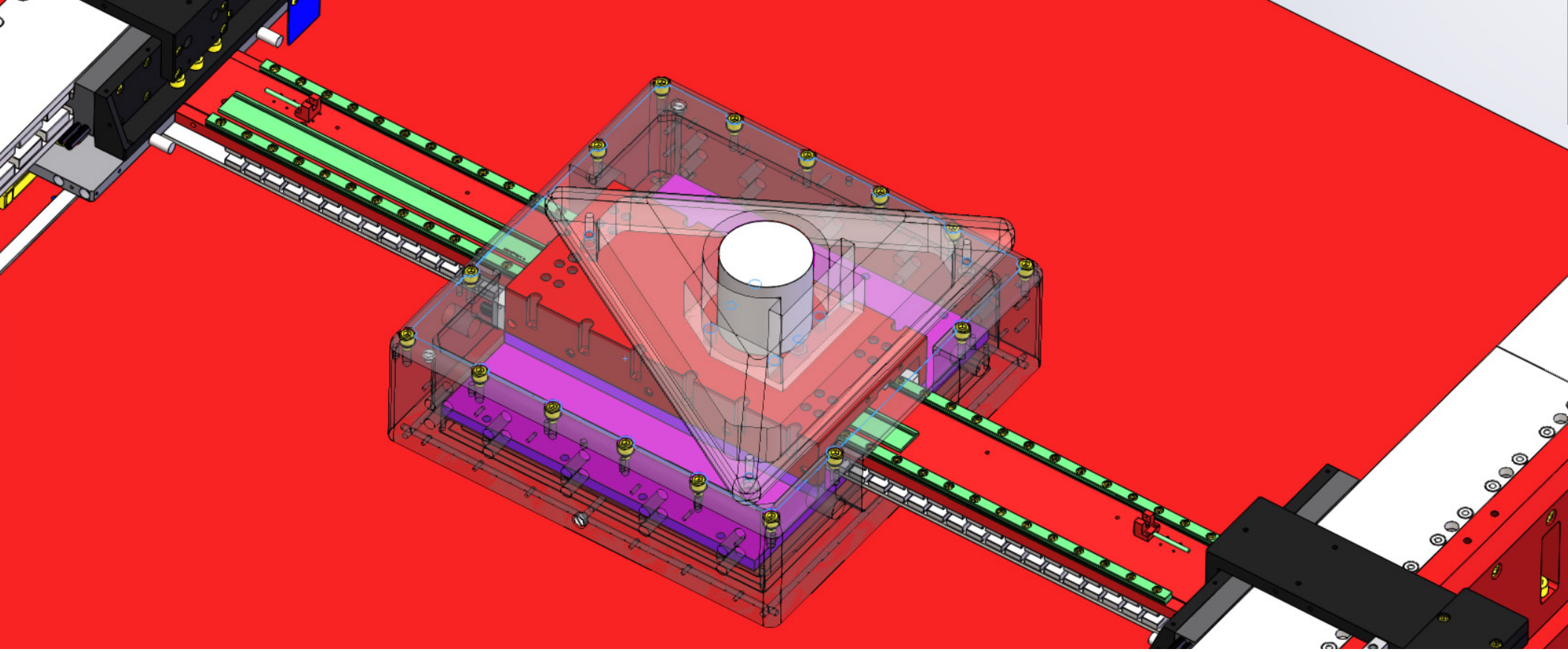
DASSAULT SYSTEMES

SOLIDWORKS

CHAPTER ONE

STEP-UP TO SIMULATION:
AN INTRODUCTION TO THE BENEFITS OF VIRTUAL PROTOTYPING





STEP UP TO A SMARTER WAY TO DESIGN

If your design doesn't work in the real world, it's a failure – a basic principle that every good designer understands. It's also the primary reason physical prototyping has traditionally played an important role in the product development process for manufacturers.

Prototyping allows manufacturers to physically test a new design to failure, gain insight into real-word performance and ensure that major design flaws are identified and mitigated before the final product ships. The result has been more reliable products, but unfortunately, the physical "design/build/test" process has also added significant cost and time to the product development cycle.

Fast forward to 2017 where new simulation tools are freeing designers from their dependence on costly physical prototypes. Simulation is cutting product development cycles and allowing manufacturers to bring better products to market faster than ever before. And the best news of all? Simulation is no longer exclusive to large manufacturers with deep pockets.

Powerful Simulation Tools

Simulation is now a simple, easy and cost-effective way to create products that exceed customer expectations. And if you're a current SOLIDWORKS® user, simulation capabilities will be nothing new to you.

SOLIDWORKS Premium includes both motion and structural analysis tools. This allows designers to simulate the effects of real-world forces and movements on their products, so they can gain a clear understanding of the strength of a design and identify potential weak points or overly designed components. These tools, for example, can simplify assumptions in the component material behavior, which speeds up the solution time, allowing for simulation to be carried out as part of the design process rather than at the end.

Simulation is changing the game for designers, but the simulation and analysis capabilities included with SOLIDWORKS Premium only scratches the surface – opening up a whole new world of testing opportunities when transitioning to SOLIDWORKS Simulation Standard and Professional.

More than just "Lucky" Lindy

One of history's greatest design and engineering feats took place in the early morning hours of May 20, 1927. That's when Charles Lindbergh took off from Roosevelt Field near New York in a small, single engine airplane. His goal: to fly nonstop from New York to Paris, solo. It had never been done before, and by this point in time numerous pilots had died trying. But Lindbergh had something the others didn't, and it wasn't just talent, money, or luck. He had an airplane whose design had been optimized solely for the task.

Lindbergh (and his modified plane) made history when they landed at Le Bourget airport in Paris, and his legacy of innovation lives on. Today, the notion of optimizing designs isn't just limited to airplanes, but includes everything from heavy-duty industrial machines to delicate medical instruments. While Lindbergh's development process was very much trial and error, sophisticated software would have easily allowed him to virtually test whether it was better for the structural balance of the craft to move the engine forward, and answer other questions, on the ground before taking to the skies.

SOLIDWORKS SIMULATION STANDARD

When it comes to testing weak points, the right tools can make all the difference. As an add-on to SOLIDWORKS, the Simulation Standard package is a straightforward way to achieve a greater understanding with minimal effort.

THE BEST TOOLS LEAD TO BETTER DECISIONS

The following features are included with Simulation Standard and provide simple, easy ways to validate performance.

Trend Tracker

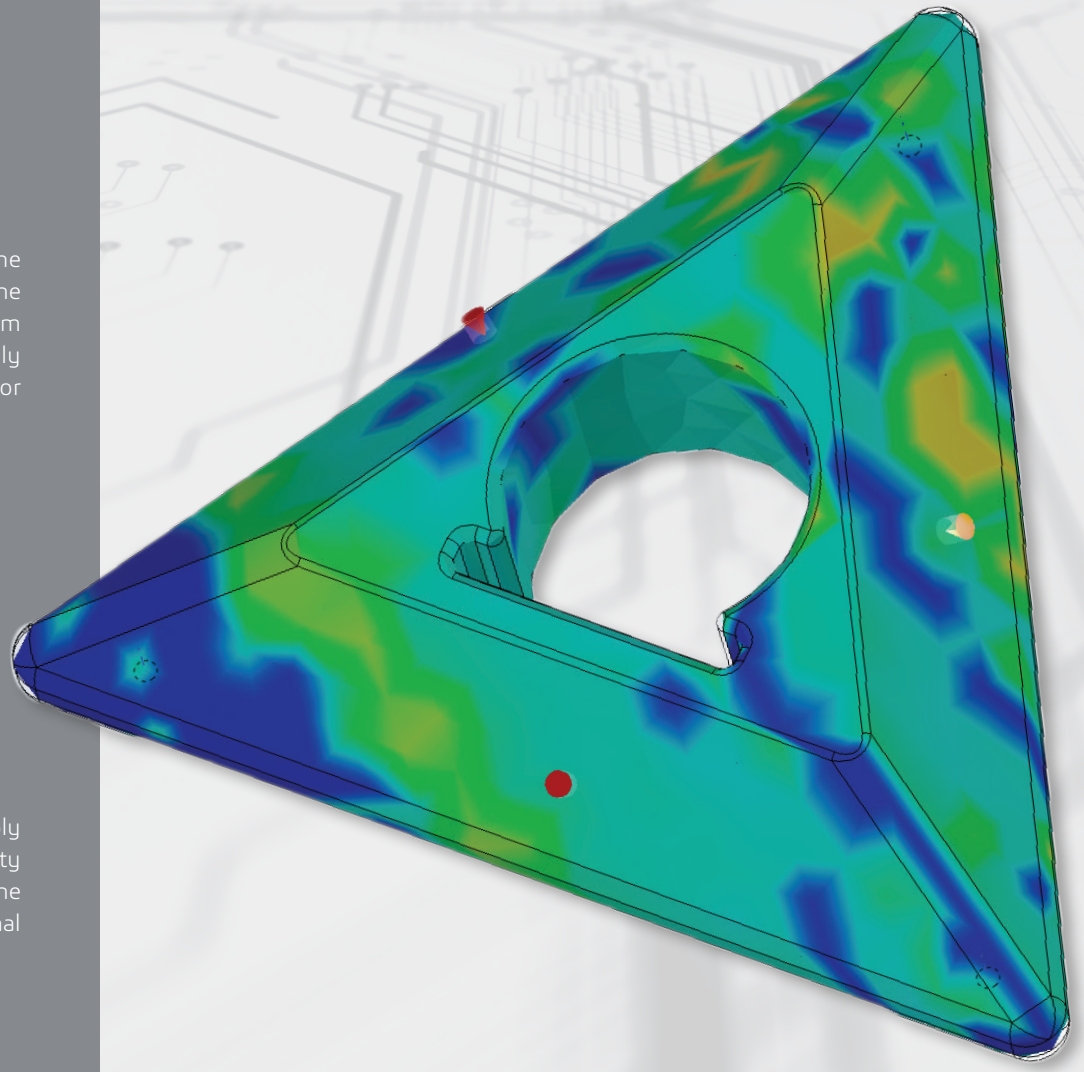
Using simulation as part of the design process makes sense because the results can highlight issues that would otherwise be undetectable. But over the course of a design evolution, it can be hard to keep track of the effects from the changes. Trend tracker enables you to set a baseline analysis and easily compare the impact of design changes on key criteria like maximum stress or maximum displacement.

Fatigue Simulation

The majority of metal structural failures are due to fatigue. Even if the component stresses are below yield, failure can occur if the component experiences a repetitive load cycle. SOLIDWORKS Fatigue Simulation provides a clearer picture of how repeated or random load cycles can cause structural failures in your design under a high cycle fatigue. Fatigue analysis allows you to move from 'Design for Strength' to 'Design for Life'.

Time-based Motion Simulation

Time-based motion analysis is a method of evaluating the physics of assembly motion where components move over a set period of time. It adds true physicality to assembly movements using gravity, friction and mass, and calculates the body, joint forces and motions under both external (environment) and internal (motors, springs, etc.) loads.



"The FEA studies that we conduct with SOLIDWORKS Simulation software are vitally important because they help us ensure top system performance without spending time and money on prototypes."

— Yong Peng Leow,
Co-Founder, Akribis Systems

WHERE VALIDATION PAYS OFF

Akribis Systems Pte. Ltd., is a leading manufacturer of motion control positioning systems for industrial customers working in fields ranging from biomedical applications to mobile phones. When the design team needed an affordable and straightforward way to ensure a high level of quality in its machines, they turned to the FEA tools in SOLIDWORKS Simulation Standard.

Optimizing to Outperform

With systems that involve high-speed motion, verifying vibration characteristics is critical. By conducting kinematics, linear static stress and strain, and frequency analyses of parts and assemblies, Akribis has confirmed design performance and optimized the stiffness-to-mass ratio of its products. The result has been superior products that outperform previous benchmarks and save time and money that might otherwise have been spent on physical prototyping.

RESULTS:

30-50%
REDUCTION IN DESIGN CYCLES

15-20%
SHORTER TIME-TO-MARKET

Take the Next Step: Simulation Professional

As you've seen, SOLIDWORKS Simulation Standard is an easy step you can take to help ensure your designs are strong enough to handle their real-world environments. But what if you want to go beyond ensuring your designs will work, and optimize them for a variety of considerations? Then it's time to take the next step to SOLIDWORKS Professional.

> "A small change can have a big impact on the overall function of your product."
>
> — Stephen Endersby
> Director Product Portfolio Mgmt., SOLIDWORKS

The Tacoma Narrows Bridge Comes Tumbling Down

Completed in 1940 and nicknamed "Galloping Gertie" by the construction workers who built it, the Tacoma Narrows Bridge was in use for just four months before its collapse. Engineers failed to foresee the effects of high winds, which funneled through the Tacoma Narrows strait and generated a strong, periodic frequency that matched the bridge's natural structural frequency. This caused the bridge to sway back and forth violently, and ultimately crumble into the water below.

This oft-cited story is a striking example of why a thorough understanding of how designs will react in a real-world setting is not just a nicety, but a necessity. The Tacoma Bridge is an extreme example, but the problems of resonance or harmonics can be felt in far simpler ways. Take, for instance, the electronics boards used in the engine control units (ECU) of most modern cars. If the ECU has the same resonance as the engine or the suspension, the board will shake and the electrical joints will fail, causing the engine to stop. If that happens on a bumpy country road or in the middle of an expressway at rush hour—you've got big problems.

The examples of the Tacoma bridge and engine control board highlight the importance of anticipating how your designs will perform in operational situations, and what can happen when they don't.

SOLIDWORKS SIMULATION PROFESSIONAL

Continual Design Improvement through the 'What-If?' Game

Asking questions and answering them confidently, without physical prototyping, is one of the strongest arguments for simulation. When working inside SOLIDWORKS Simulation Professional, the process of asking questions such as: "What if I reduce the size of this hole?" or "What kind of plastic works best for this part?" can be answered, and verified, in little to no time. This is thanks to powerful analysis tools that form a multi-physics environment and enable a greater understanding of performance.

Frequency Analysis

If your product contains rotating or reciprocating components, the danger of inadvertent resonance is real. By using frequency analysis, you can obtain the component's natural frequencies of vibration. Correlating this detailed vibration data to the forcing frequency of the environment or rotating/reciprocating components is critical to ensure safety and optimum product performance.

Thermal Analysis

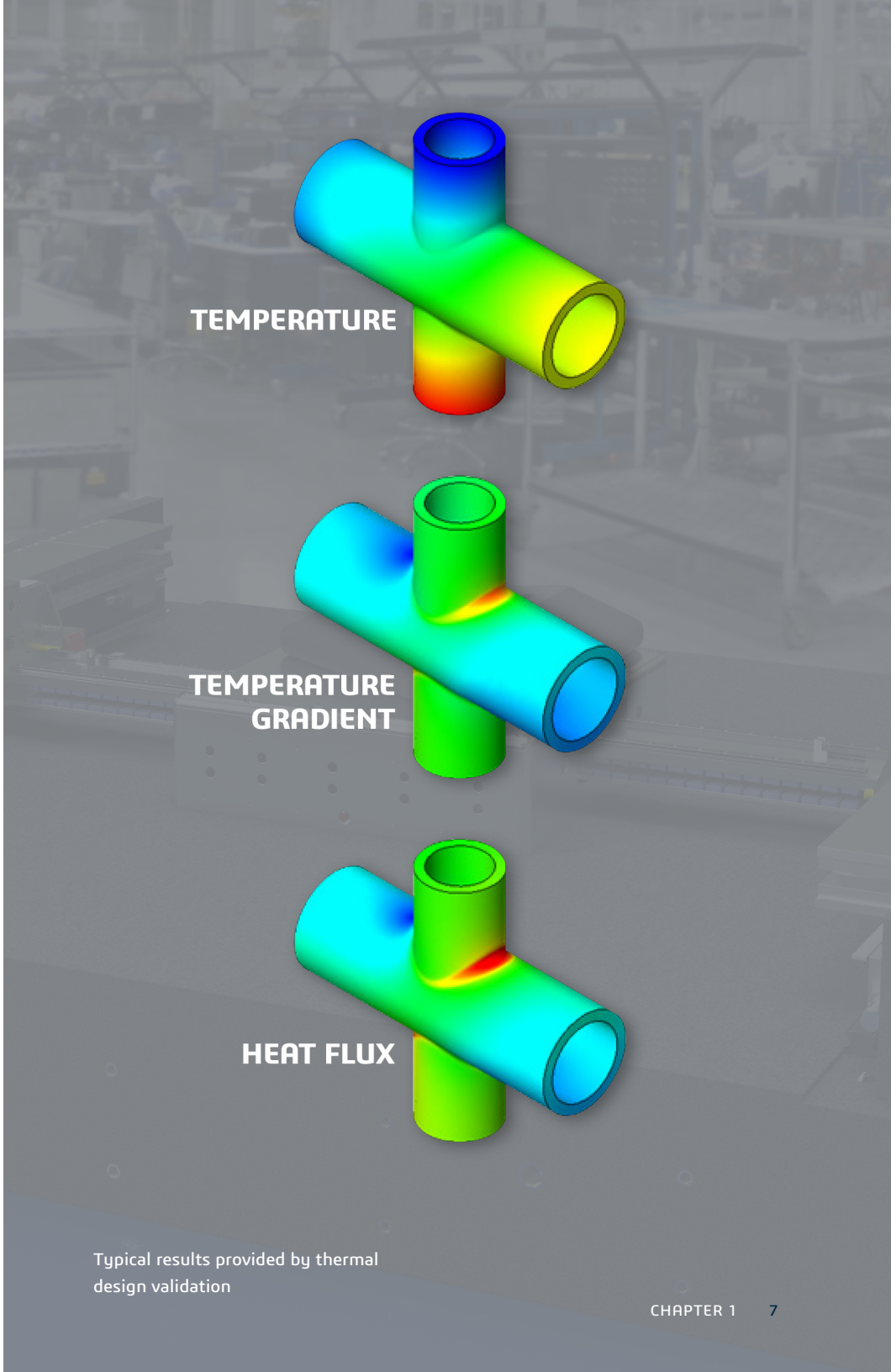
Understanding the thermal characteristics of your design is important for both safety and performance reasons. Solving conjugate heat transfer issues during the design process enables design teams to avoid or mitigate thermal issues with minimal cost.

Thermal Structural Analysis

Once you have calculated the temperature distribution throughout your product, the next step is to understand the stress and deformation due to different material coefficients of expansion.

Structural Optimization

Reach the best available strength-to-weight ratio, frequency response, or stiffness performance for your product with a goal-driven design parameter optimization solution. Flexible 'goals' (or parameters) can be set and SOLIDWORKS Simulation will alert you when they are violated.

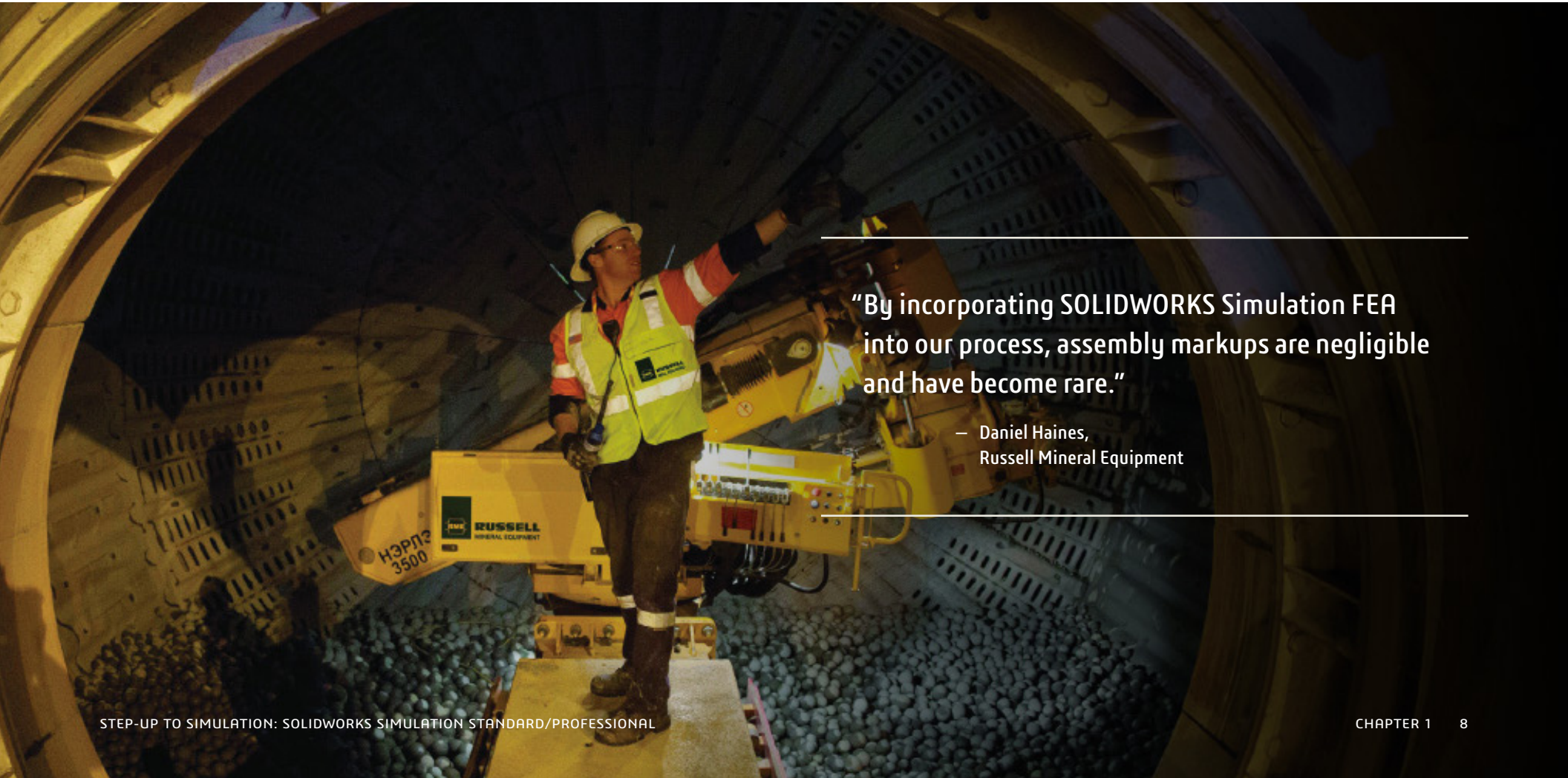


Typical results provided by thermal design validation

MINING FINITE ELEMENT ANALYSIS FOR BETTER DATA

Russell Mineral Equipment (RME) is one of the world's leading manufacturers of specialized equipment and services for the hard rock mining industry. In an industry where malfunctioning machinery can cost more than just money, products that perform flawlessly and safely are vital. When RME made the jump from 2D to 3D design software, finding a solution that could help the company better understand the real-world performance of its machines was key.

Using the finite element analysis (FEA) capabilities of SOLIDWORKS Simulation Professional, RME predicted the stresses in every part of its RUSSELL Mill Relining Machine. This allowed them to identify weak points and shore them up at the design phase. The transition has helped improve machine quality, as well as turnaround. As a result, RME has gone from a project-based company, to a production-based one.



"By incorporating SOLIDWORKS Simulation FEA into our process, assembly markups are negligible and have become rare."

– Daniel Haines,
Russell Mineral Equipment

DOWNLOAD NOW

Don't miss the next chapter in our SOLIDWORKS Step-Up to Simulation Series.

CHAPTER 2

SOLIDWORKS SIMULATION PREMIUM

There's More Steps to Take

This is only the first chapter of the Step-Up to Simulation series. Continue along to find out what's inside SOLIDWORKS Simulation Premium, Flow, and Plastics, and how these tools can revolutionize your design-to-manufacture process.

Visit **solidworks.com/STEPUPTOSIM** for more!

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