Car Seat Manufacturer Cuts Costs and Improves Quality With **Stamping Analysis Tool**

By **Michael Walters, Advanced Manufacturing Engineer, Adient, Michigan, USA**

Adient is an automotive company that uses FTI Formingsuite COSTOPTIMIZER professional sheet metal simulation software to efficiently communicate design changes and reduce rework.

According to automotive manufacturer Adient, 1/3 of all cars feature the company's components. As such, there's an inevitable pressure on Adient to continually innovate its offering and manufacturing processes. With increasing incentives for manufacturers to deliver more fuel-efficient products, Adient's Michigan-based team opted for a new stamping analysis tool to help design lighter car seats while improving processes to save time and reduce material waste.

Every year Adient supplies seats and components for more than 25,000,000 cars. But the company's influence in the automotive market isn't limited to its overwhelming representation in today's vehicles. It also places an incredible responsibility on the company's designers and engineers to lead the way for tomorrow's vehicles.

More and more, the automotive industry is under regulatory pressure to boost fuel efficiency and cut emissions. As such, the lightness of cars is an increasing focus for automotive manufacturers, particularly given the growing prevalence of electric vehicles and consumer concern about how far these vehicles can travel before needing to recharge. To drive greater fuel economy in petrol and electric vehicles, Adient is continually working to make seating even lighter. Since around 2010, Adient has reduced the weight of its seats by between 20 to 30 percent. The current goal: to produce seats weighing only 10 kg (22lbs) or less by 2020.

To achieve this goal, the team at Adient explored the forming capabilities of higher strength steel and hybrid materials, as well as lighter and thinner structures and mechanisms to lower weight by up to 25 percent. But the company's previous method of determining manufacturability of new designs was causing problems.

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Adient wanted to test the feasibility of design changes before parts reached the production floor to avoid splitting, necking, wrinkling, and other stamping defects. With the company's previous process, a drawing would be signed off by stamping engineers, but the assessment of its feasibility was largely unstandardized and based on the engineer's experience. The tooling shops would produce a form simulation, and if issues were found, it would be sent back to the stamping engineers, who would in turn send it back to the product engineers.

Besides causing inefficiencies and contributing to lost time and materials, this process didn't maximize the team's capabilities for innovation, as past experience didn't offer the full understanding designers needed to assess different forming capabilities and potential problems that might occur using new alloys and materials.

Optimizing Manufacturability

Adient's partnership with FTI stretches back into the company's history before its emergence as a spin-off of Johnson Controls, which saved time and money by acquiring a range of FTI solutions, including the material cost reduction tools COSTOPTIMIZER, FASTBLANK, and FASTFORM Advanced.

Adient opted for FTI's stamping analysis tool FORMINGSUITE COSTOPTIMIZER PROFESSIONAL to evaluate the manufacturability of designs, performing fast blank size calculation, blank overlap detection, springback analysis and determining thinning strain limits.

Using COSTOPTIMIZER PROFESSIONAL, the designs are evaluated according to three key factors: Forming Limit Diagrams (FLD), thinning strain, and thickening strain. For Advanced Manufacturing Engineers at Adient, the FLD is absolutely crucial. FLD is everything. It's different for every material. It doesn't matter what the thinning or thickening strain is; if there are points above the FLD major strain line, the part will fail.

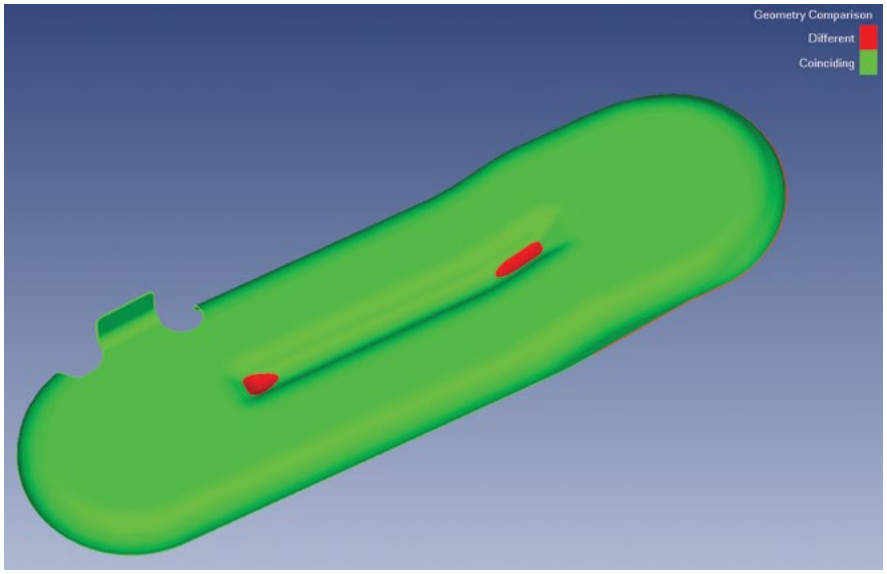
AI17 Front Seat Conversation Mode

COSTOPTIMIZER PROFESSIONAL'S user-friendly capabilities for interpreting these three factors has enabled Adient to drive improvements in the use of materials and product design. For example, by giving designers precise insight into the percentage and location of thinning strain occurring in a mounting foot for a seat rack, Adient could increase the part's thickness from 2.2 to 2.5 mm while reducing thinning strains from 32 to 18 percent.

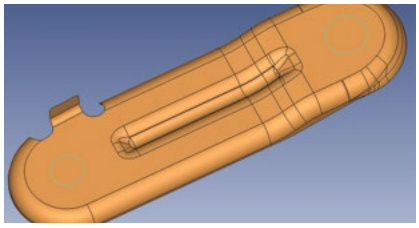
The digitization and simulation of part manufacturability has been invaluable for Adient in gaining a greater understanding of parts. "When looking at a blank it might appear normal, but the software makes it easy to identify characteristics that you might not perceive with the naked eye, like for example blank overlap where flanges are too tall in the corner," says Michael. "Previous processes were very much based on drawing upon experience and FormingSuite really allows us to build on that, increasing confidence in our analyses."

"Since introducing FTI, Adient now requires a passing grade for forming simulation on all stampings prior to being released for production. Forming-related problems during die tryout have been practically eliminated, which in turn saves money on the bottom line. In 2018 alone, I performed approximately 1,800 feasibility simulations", adds Walters.

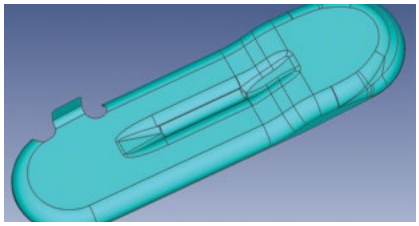
Countermeasures – The Communication Key



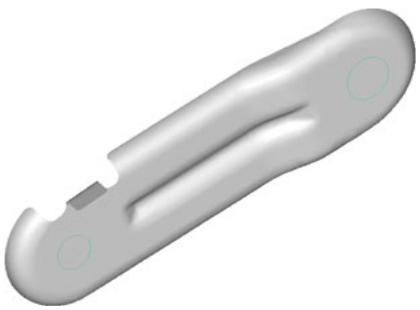
Use the "Compare Geometry" function to overlay the 2 versions.

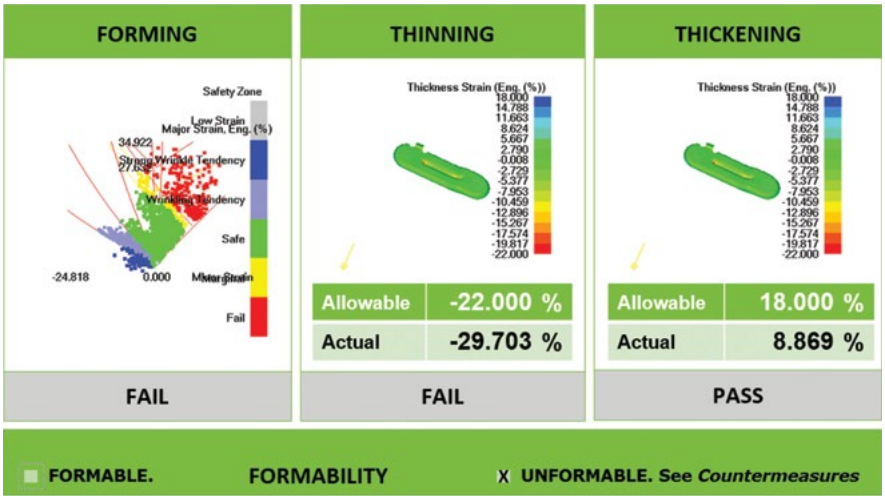


Original Geometry



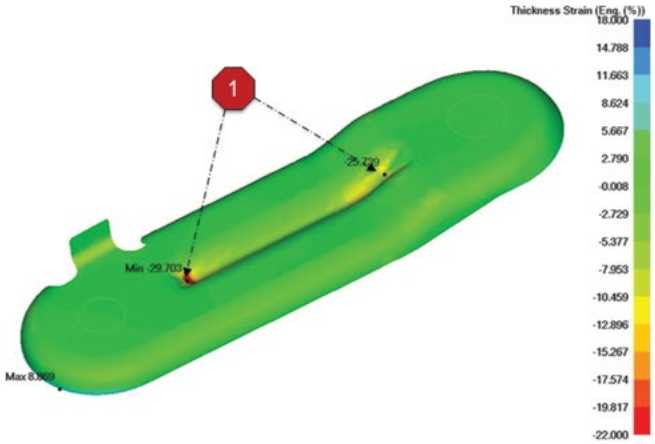
Revised Geometry





The Counter Measures page is where you can tell the Product Engineer what needs to be changed in order to make the part formable. Remember that the part must pass all 3 criteria: FLD, Thinning, and Thickening. This part passes Thickening, but fails both FLD and Thinning.

Countermeasures

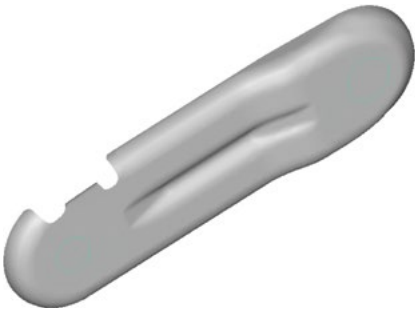


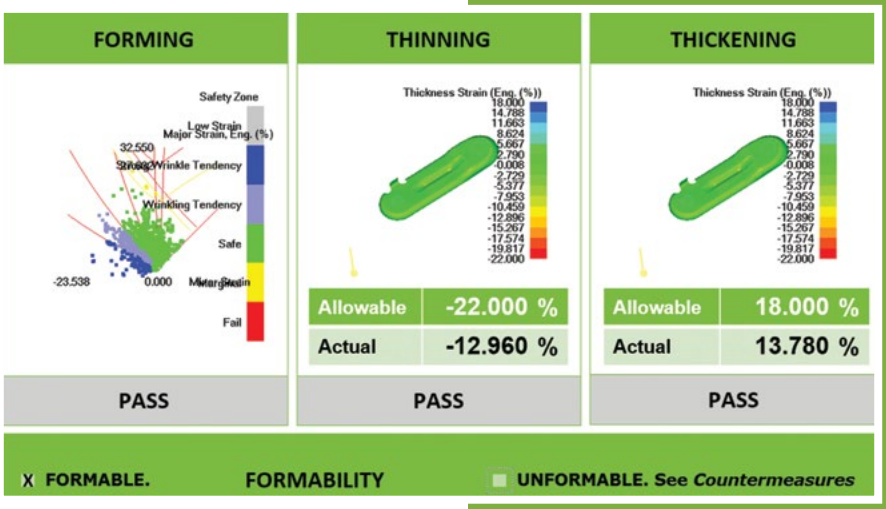
1. Thinning strains exceed the maximum allowable - risk of splits. Decrease depth of bead.

It was clear from the analysis that the bead was set too deep into this material at the ends (490XF, 2.5 thick)

By simply reducing the depth of the bead at the ends, the part now passes all 3 criteria.

FORMINGSUITE'S communicative capabilities has helped Adient avoid making parts that are unfeasible, saving time and resources and reducing bottlenecks. Using the software's intuitive countermeasures page enables users to communicate to the product engineer important changes that need to be made. "We now have a stronger communication process and can ensure that designs that have issues don't go to production," says Michael. "By catching and fixing problems early on, significantly fewer parts are coming back from our tool shops and we've seen an encouraging reduction in waste and reworks."



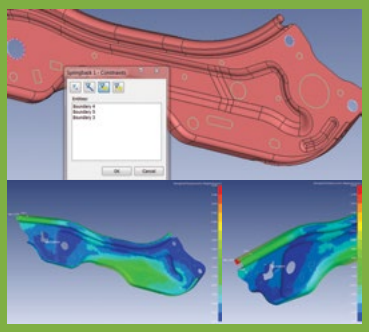


With a more streamlined manufacturability assessment process, Adient is firmly in the driver's seat to continue solidifying its position as one of the leaders in automotive seat production.

Tolerance Negotiation – Using Springback Analysis

Knowing how the part will be located in the check fixture is key to getting a meaningful springback analysis.

In this example, I have left the B1-B2 and C datums unfilled, as these will be pinned in the fixture. The surface below these datums will create the A1, A2, & A3 datums and will be clamped on them.



Now the results look more realistic!

Here's where the tolerance negotiations begin.

Let's say the Engineer wants a 1mm profile around the hole at the top of the curl. You can easily prove, with this data showing 1.87mm springback that it is not possible – you need at least a 2mm profile.

Or take the forward-most hole in the side of the bracket. If the Engineer wants a 0.5mm profile, it may not be possible. Better to ask for at least 0.75mm profile.