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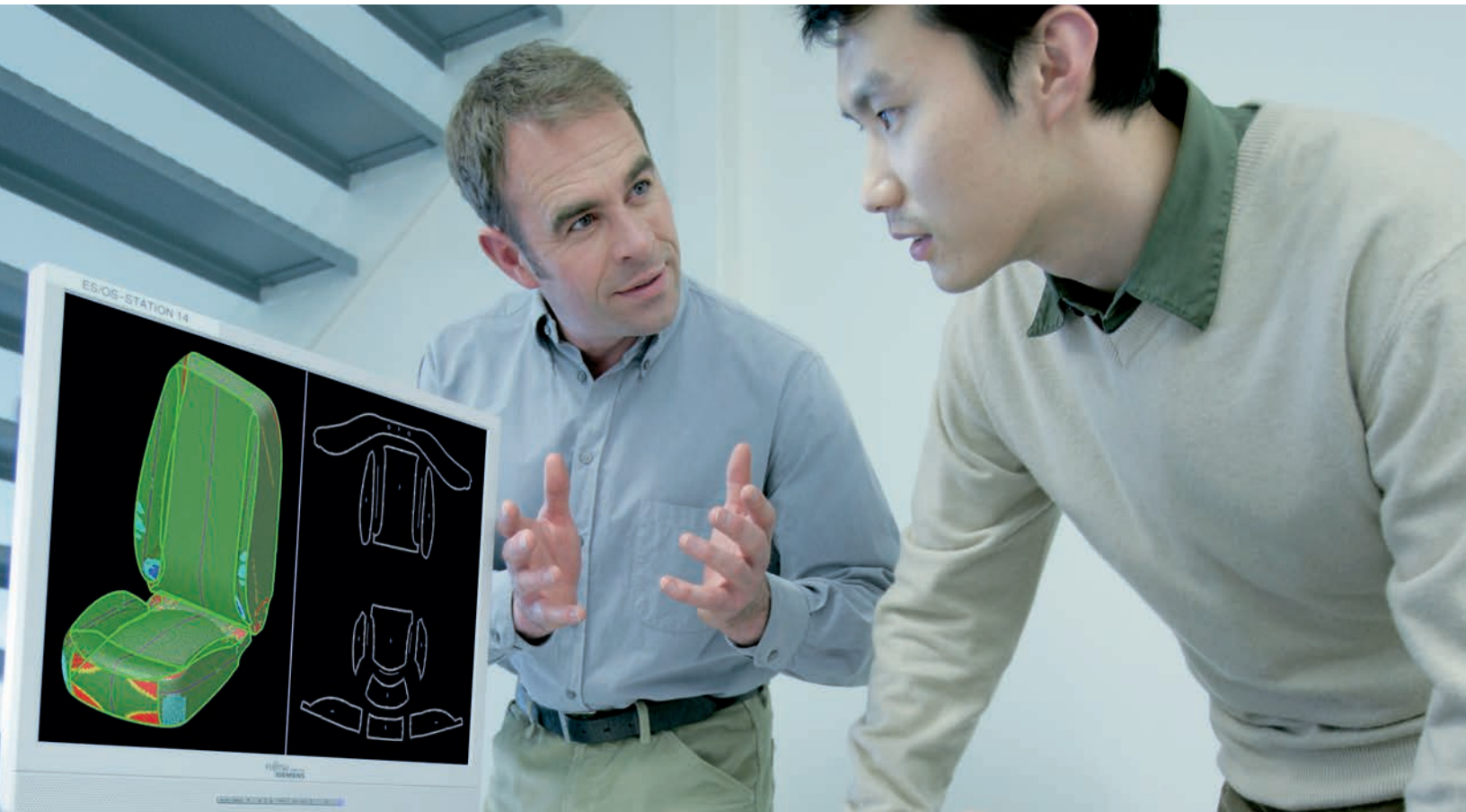
Ingenuity for life

Siemens PLM Software

Mastertrim

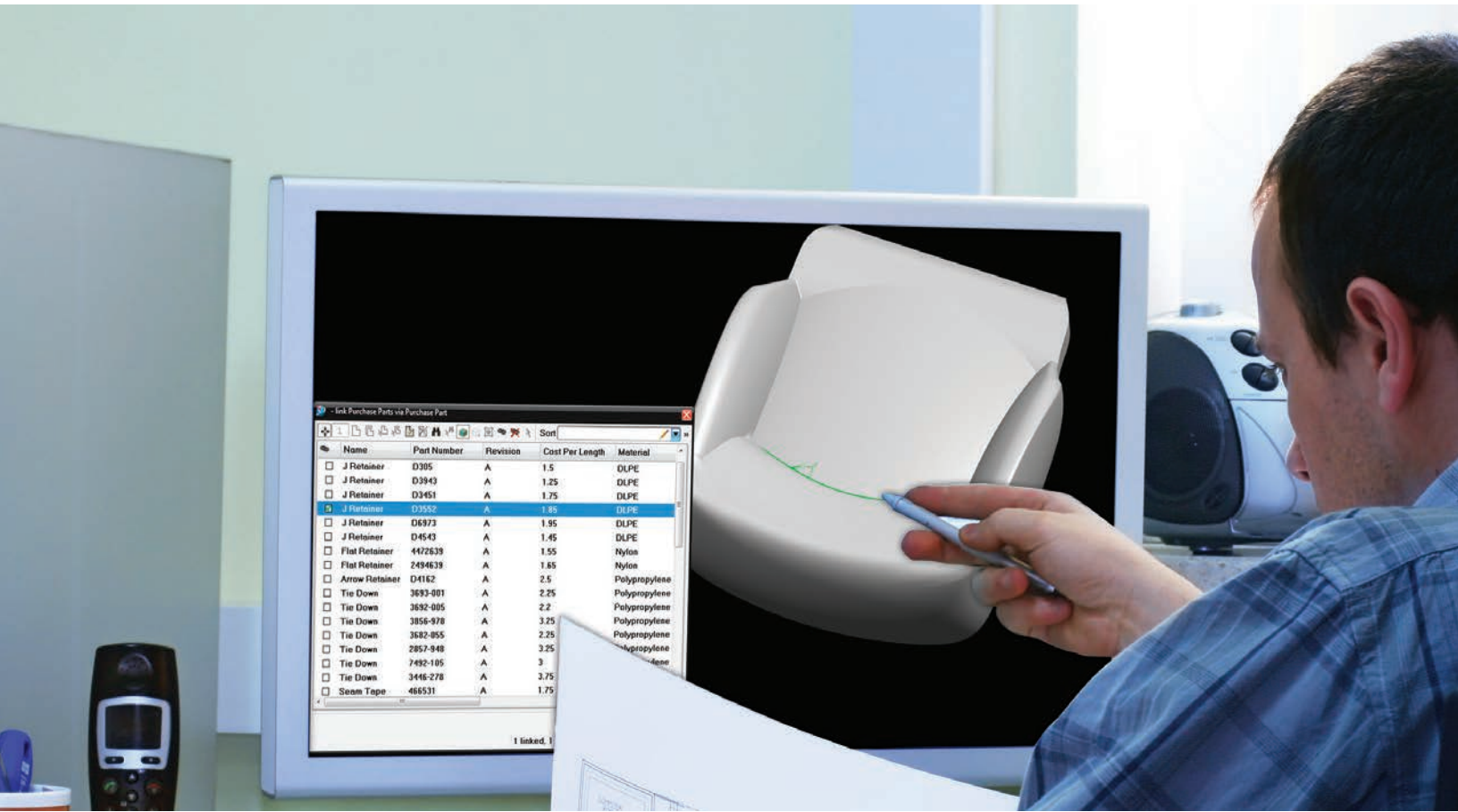
Driving 3D engineering of
innovative transportation seating
and interiors

[siemens.com/plm/mastertrim](https://www.siemens.com/plm/mastertrim)



Seat engineering is becoming incredibly complex. Engineers have to manage an increasing amount of information for a rapidly expanding number of transportation models and interior variants. And this information must be captured accurately and unambiguously in a single 3D master model within the CAD system to ensure that the product is both efficiently manufactured and precisely meets styling requirements. This complexity, along with the pressure to reduce prototyping costs, shorten time-to-market and satisfy customer demands for comfort, style and safety, puts enormous demands on engineers. Specialized engineering software that reflects the unique terminology and methods used for seat engineering are vital for meeting all the requirements and streamlining processes.

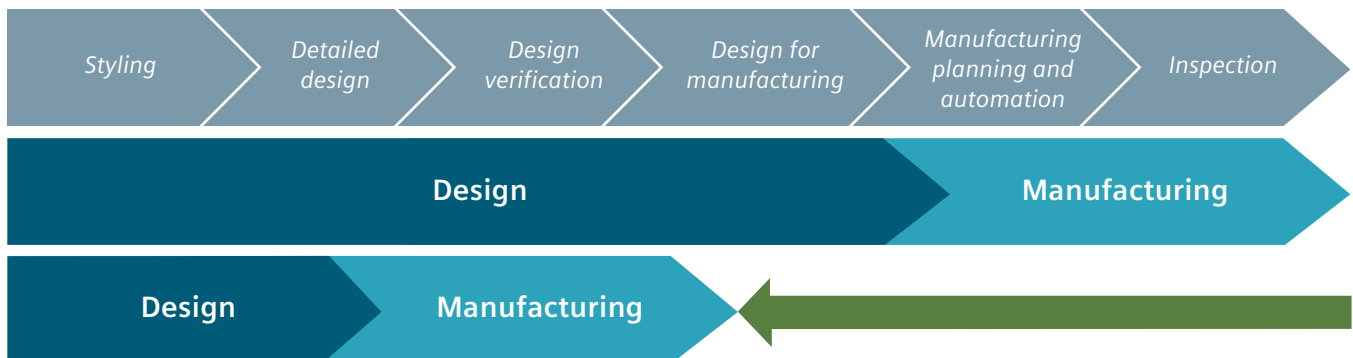
That's exactly what the Mastertrim™ portfolio of software for engineering transportation seating and interiors from Siemens PLM Software provides: specialized solutions for designing and manufacturing seat systems and interior components on time and on budget.



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Integrate the entire seat development process



Mastertrim compresses the design-to-manufacturing process for transportation seating and interiors by 80 percent.

“Time is of the essence in the automotive business, whether you’re talking about preparing bids or delivering new products. Based on our evaluation, we believe that Mastertrim will enable us to save a significant amount of time, perhaps as much as two weeks, in the development of initial flat patterns. The addition of this technology will complement our existing processes and add to our competitive advantage.”

Brian Thiele, executive manager
Engineering & Development
Futuris Automotive

Mastertrim enables engineers to design and manufacture innovative transportation seat systems and interior components and allows them to capture a complete digital product definition, which accurately and efficiently shares design detail, eliminates extensive physical prototyping and reduces time-to-market. Mastertrim helps engineers increase efficiency and control of the seat engineering and manufacturing process from styling to production. With a single data source for all design and manufacturing information, engineers can easily develop and verify designs based on customer requirements while reducing cost and prototyping time.

Mastertrim delivers

Improved time to first proof of concept seat cover by reducing time to create initial flat patterns from days or weeks to just hours

- Reduced time to generate bill of materials (BOM) and cost estimate from 2-3 weeks to just hours
- Reduced time to initial drawings, manufacturing documentation and quotations by over 90 percent
- Reduced time to process changes, generate updated drawings and documentation by 75 percent
- Improved engineering processes by reducing time to first concept from weeks to days
- Enhanced sourcing process with a faster, more accurate quote cycle, reducing uncertainty in cost estimates from over 5 percent to 2 percent or less

A specialized problem requires specialized tools

Seat design and manufacturing is specialized work that requires tools that enable engineers to “work how they think.” Engineers need a place to create a complete digital product definition that contains detailed information to guide them through the entire process, and a means to author and share a massive amount of documentation to support the process. Creating documentation by manually entering specifications multiple times is tedious, error-prone and time-consuming. For years, engineers have listed specifications and manufacturing notes manually in drawings and other documentation, including manufacturing planning documents. There was no automation, and there was no single central repository for design information.

Mastertrim specifically addresses these challenges by enabling engineers to author detailed design and manufacturing data for transportation interiors to create complete 3D product definitions.

Mastertrim addresses the entire seat engineering process, streamlining the process for creating flat patterns, trim costing and manufacturing documentation. Mastertrim enables engineers to capture a complete digital product definition of a seat system, which enables the sharing of design detail, drastically reduces the need for physical prototyping and reduces time-to-market. It stores design, manufacturing, assembly and installation data, linked to the associated geometry, directly inside the commercial 3D CAD model. Mastertrim integrates with databases and other engineering applications by linking to click-and-pick thread, material and sew specification libraries, and automatically creates and formats data for use downstream. And it automates repetitive design tasks, such as calculating seam lengths, defining retainers, simulating cover fit and producing flat patterns. Using XML tools, the software delivers data in various formats that can be easily customized for the product development and manufacturing teams.

Mastertrim address the entire seat engineering process, streamlining the process for creating flat patterns, trim costing and manufacturing documentation.

Addressing the unique needs of seat design and manufacturing engineers

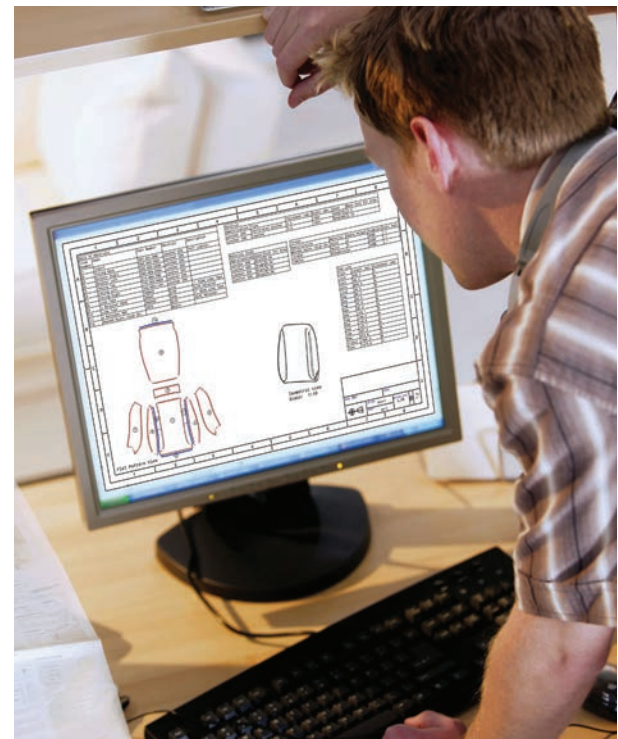
Mastertrim allows the engineer to evaluate the design and assess producibility issues, such as wrinkling, before the manufacturing process begins – saving time and money.

For design engineers, Mastertrim facilitates the authoring of data for all aspects of the seat trim cover design, including sew lines, materials, attachments and hardware data for airbags or heating systems, into a single 3D CAD master model. The software stores the design data that is linked to associative geometry directly inside the 3D CAD model. Mastertrim provides the stylist with tools for automating repetitive design tasks, such as typing the styling details of each seam and piece, as well as sketching graphics, such as decorative seams. This helps to generate a variety of deliverables, including design documentation, model-based definition formats and a bill of material (BOM). Mastertrim applies intelligence to the CAD model and enables the stylist to realize their conception. With all the information included in one 3D model, engineers can make design changes quickly and early in the development process and then efficiently share information with other teams, enabling a concurrent engineering process on the seat system.

For manufacturing engineers, Mastertrim facilitates the creation, management and communication of the manufacturing definition by consuming the design data and generating an associative manufacturing model. Mastertrim allows the engineer to evaluate the design and assess producibility issues, such as wrinkling, before the manufacturing

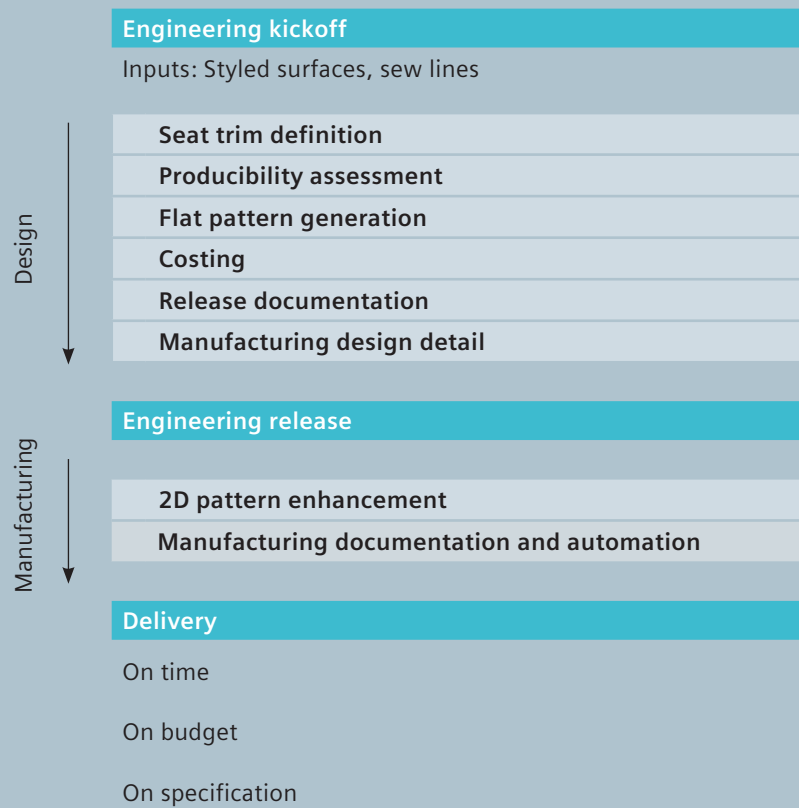
process begins – saving time and money. Manufacturing engineers can now readily receive all the automatically created data they need, streamlining downstream operations and communication with suppliers.

The result is a highly efficient process for delivering innovative seat designs.



Mastertrim is an essential tool for both design and manufacturing engineers.

Supporting the entire seat engineering process



Seat trim definition

Enabling precise and effective authoring and communication of design details

Key functionality

- Thousands of attributes can be managed and stored in the CAD model with just a couple of clicks
- Once seam locations are defined, piece shapes are automatically calculated
- Visualization of seams and seam types
- All data is stored within the CAD model so there are no extra files to track
- Defines specialized processes, such as elastic and zippers
- Familiar terminology is used because engineering process steps are built into the Mastertrim interface

Benefits

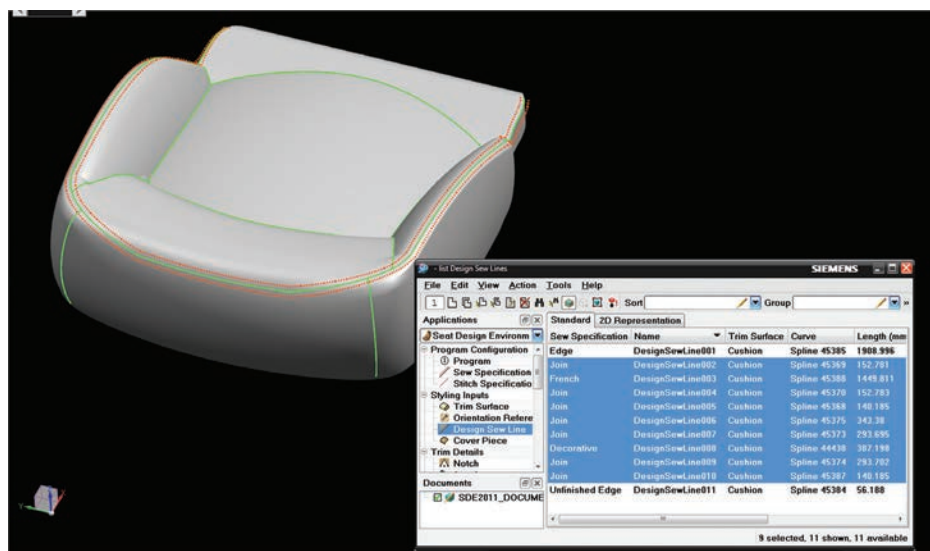
- Provides a complete trim cover definition for quoting and manufacturing
- Enables efficient data sharing across the supply chain
- Facilitates the accurate and efficient authoring and communication of design details
- Allows engineers to focus on engineering rather than finding or formatting data

Traditionally, seat trim cover definitions have been developed and communicated with hand sketches, images and written documents. Unfortunately, these kinds of manual processes are time-consuming, frequently inaccurate, always inefficient and lead to miscommunication. By contrast, introducing industry-specific engineering software into a commercial 3D CAD system, such as Mastertrim, enables engineers to create a master model that accurately and efficiently captures a complete digital product definition of the seat trim cover.

Creating a 3D master model provides a seamless way to generate and update data needed for manufacturing or to share with suppliers and customers. That is critical because the trim cover is one of the most complex parts of the seat, with over 5,000 pieces of attribute data required to define a typical seat cushion backrest and

headrest. By just pointing and clicking, Mastertrim enables you to define and place seat trim components such as seams, cover pieces and sew lines.

By implementing Mastertrim, manufacturers are able to turn a laborious, trial-and-error process into an automated, streamlined methodology that enables them to get to market ahead of the competition with lower development costs. OEMs are able to accurately communicate their intended design to their manufacturers and get a more accurate, cost-effective product back. In an industry that puts a premium on getting to market quickly with a cost-effective product, that is a very good thing.



Mastertrim converts curves into seams by associating 2D to 3D attributes, including seam, thread or needle type, and length to the curve to create a complete seam definition. Seams are then automatically combined to create pieces to which materials can be associated. The location of retainers and hardware can then be added to create a complete master model definition.

Producibility assessment

Facilitating the early diagnosis of manufacturing issues

Key functionality

- Mastertrim simulation displays areas of wrinkling and over-tension based on material properties
- Easy to analyze color scheme quickly, providing feedback on producibility results
- Changes are updated immediately
- Smoothing line allows user to control critical areas where distortion must be avoided

Benefits

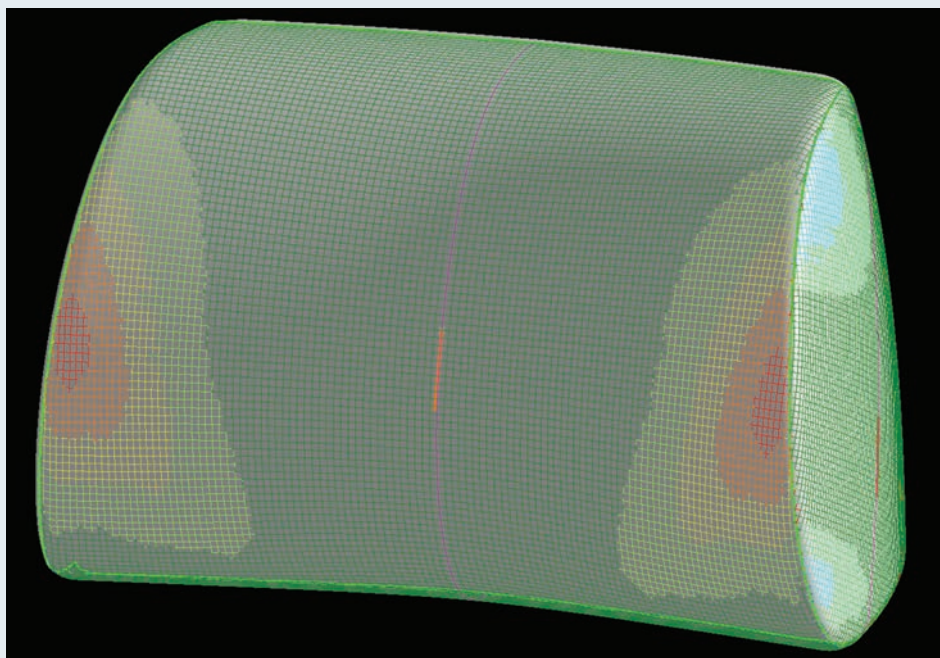
- Assesses quality of cover fit early in design process
- Evaluates complexity of manufacturing issues
- Quickly analyzes impact of changes so there is less reliance on prototypes

Currently, manufacturers and suppliers need to produce a physical prototype of the seat trim cover and have a highly experienced designer on staff to determine where problems will occur within the design. However, with Mastertrim, the producibility display can be used to identify issues that need to be addressed early in the process so they can be remedied prior to embarking on the manufacturing process. This saves time, money and helps the manufacturer win the all-important race to market.

OEMs and suppliers use a combination of seat shape, material and seam locations to determine if a seat can be manufactured. Mastertrim's simulation provides great precision by using many colors to show gradients of wrinkling and over-tension. This gives designers better insight into the degree of deformation and enables them to be more precise in modifying the piece shape for producibility or styling reasons.

This is critical because stretching and wrinkling of the material as it drapes over the seat can result in an undesirable look and an uncomfortable seat. In the highly competitive transportation industry, in which interiors in general – and seats in particular – play a key role in the buyer's decision, getting the seat trim cover right provides a tangible competitive advantage.

Mastertrim's producibility display provides greater granularity by using more colors to show the degree of deformation. This provides designers with a better idea of how to precisely modify the piece definition for producibility or styling reasons.



Flat pattern generation

Saving time and material when developing production patterns

Key functionality

- Advanced algorithms generate highly accurate 2D patterns from 3D
- Associativity between 3D piece and corresponding flat pattern
- Flat patterns include seam allowance, notches and grain direction
- Automatically generates flat pattern and layouts
- Exports patterns directly to nesting and cutting software

Benefits

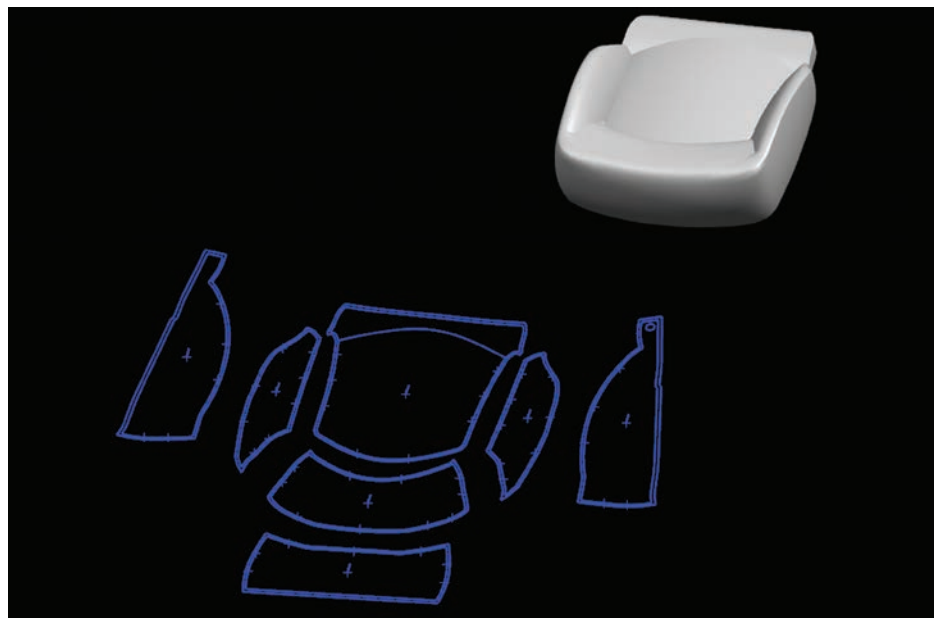
- Facilitates a concurrent process so no foam model is needed initially for developing flat patterns directly from the 3D surface
- Saves significant time and material when developing final production patterns
- Allows quick changes and accountability to desired shape
- Eliminates need for manual storage of Mylar patterns or templates

One of the biggest challenges facing seat trim cover manufacturers is making 3D shapes from 2D patterns, no small task given how difficult it is to predict how 2D patterns will fit over complex 3D shapes. The traditional way to handle this operation includes myriad iterations and a trial-and-error process of cutting and sewing to produce a precise pattern. This inevitably leads to a colossal waste of time and material. Additionally, the foam model must be produced prior to the development of the seat trim cover.

However, Mastertrim transforms this process by enabling you to employ a concurrent engineering process so you can work on the foam model while developing the seat trim cover, saving significant time.

Mastertrim automatically generates flat patterns and captures downstream design changes, generating 2D patterns for prototyping and production, then easily and accurately capturing all alterations and design modifications and reinserting them back into the 3D master model, regardless of format.

And since Mastertrim is an open environment, it enables you to maintain full compatibility with your current systems so you can export flat patterns to all major nesting and cutting systems for a more efficient transition to manufacturing.



Once pieces are producible, flat patterns can be generated automatically and are fully associative to the 3D piece definitions. Patterns will include notches (defined in 3D), seam allowance, grain direction and miters. There is full associativity between the 3D definition and the 2D patterns. Exploded views (sometimes referred to as orange peel) can also be created automatically.

Costing

Providing cost certainty for seat trim cover manufacturers

Key functionality

- Automatically populates documents related to costing
- Exports patterns to nesting software for accurate calculation of nesting efficiencies
- Automatically generates data needed to feed cost programs
- Recreates costing data after change occurs with a push of a button

Benefits

- Evaluates cost impact for proposed changes
- Reduces bidding response time
- Identifies cost drivers early on during the bidding and engineering processes
- More accurately predicts manufacturing costs

It is difficult to accurately estimate seat costs during bidding or even early in the engineering process. Manufacturers will use parametric or historically-based cost modeling which is not necessarily sensitive to design detail. In fact, costing is often based on a complexity rating of simple, moderate or complex, a rather imprecise methodology.

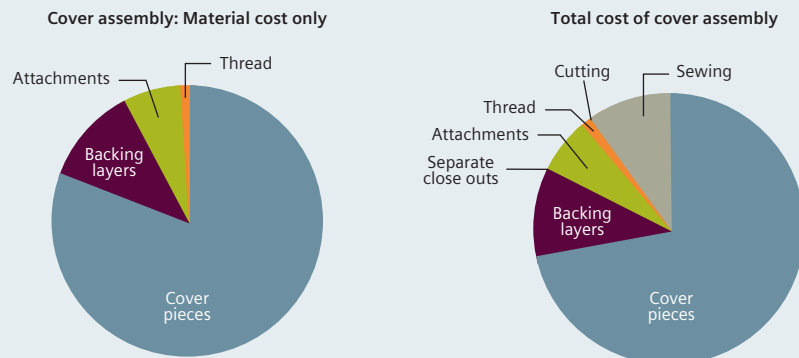
By contrast, Mastertrim features design-based cost modeling. Small changes in designs can have a dramatic effect on costing, and Mastertrim is designed to pick that up. In fact, Mastertrim facilitates the bidding process because it has a utility for exporting data directly into a manufacturer's cost model, thus enabling

them to quickly calculate a bid based on their parameters and requirements.

As a result, Mastertrim enables you to understand the cost of potential product modifications, shortens the time it takes to submit a bid, identifies the issues that are driving costs early on and accurately forecasts manufacturing costs.

“The best part of Mastertrim is that it provides us with an early calculation of the cover cost, which gives us a competitive advantage, especially when submitting a bid. It also enables us to react quickly to any manufacturing issues. Mastertrim helped us reduce the cost of the entire design-to-manufacturing process.”

Nicolas Michot, manager
R&D seat division and senior trim expert, Faurecia



Mastertrim allows you to interface directly with your company cost models and provide cost feedback early in the design process by quickly evaluating the impact of design features and design modifications.

Release documentation

Streamlining the process of developing documentation for manufacturing

Key functionality

- Generates BOM and engineering drawings for release documentation
- Automatically creates tables, images and text
- Can be easily customized to list specific data in desired format
- Enables labeling of seam, piece and attachments details
- Full associativity between 3D definition and documents

Benefits

- Master model enables automatic generation of documentation
- Reduces errors and the time it takes to manually create documents

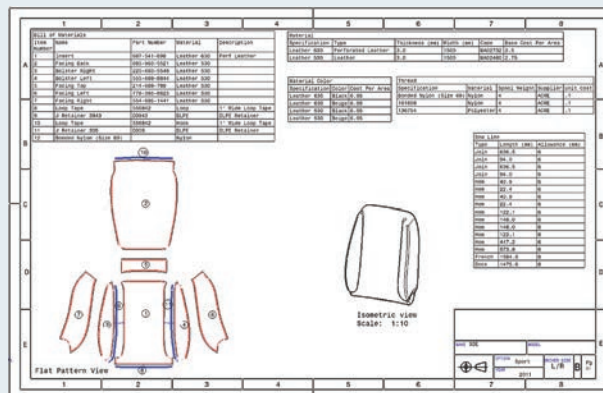
Engineers who develop seat trim covers are faced with the tedious and complex task of creating accurate design and manufacturing documentation. In the past, this has been a mostly manual and challenging responsibility, made even more complicated when changes are made to the design.

One of the biggest challenges when it comes to documentation is communicating between the design team and manufacturing. That's because while the product design is developed on a 3D CAD system, that system is often not used in manufacturing, so there needs to be a way to communicate 2D documentation between them. Currently, that is a time-consuming, labor-intensive and error-prone process because when changes occur they must be cascaded into all relevant documents.

Mastertrim resolves that issue by enabling the development of a master model, allowing engineers to automatically generate a variety of documentation that can be quickly and easily customized, including:

- Engineering drawings
- Sewing instructions
- Exploded or orange peel views of pattern pieces
- Bill of material (BOM) tables
- Annotations

As changes are made to the design, documentation is easily and automatically updated and can be shared across the enterprise to ensure accurate manufacturing, reduced cycle times and decreased costs.



Mastertrim generates engineering drawings that provide all relevant design information in a single, one-page document. This helps communicate design intent to the design and manufacturing teams, resulting in increased accuracy and a reduction in overall product development time.

Manufacturing design detail

Enhancing communication between design and engineering

Key functionality

- Point-and-click functionality to define locations for a variety of items including attachments, clips and labels
- Provides visual feedback on location, style and length
- Delivers automatic measurement of lengths in 3D
- Includes reference database of purchased parts for definition of details
- Supports unique details such as zippers and elastics

Benefits

- Enables storage of details in 3D master model for easy reference and manipulation
- Enhances connection and communication between design and engineering

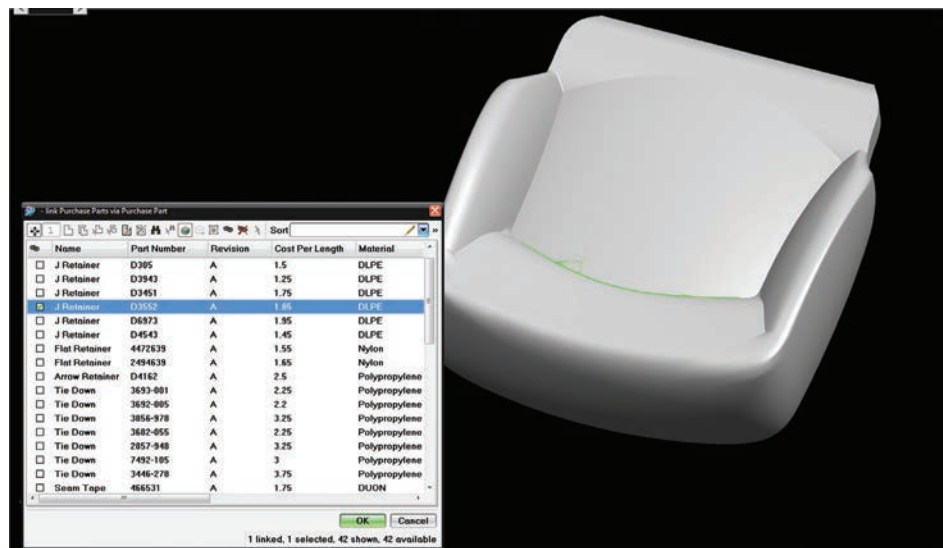
Typically, stylists and design engineers don't provide manufacturing design detail so this information must be added before the manufacturing team can produce the seat trim cover. The details that need to be added include items such as attachments, clips and labels. These details and the consequent change in costs must be tracked to ensure a seamless and transparent operation.

Mastertrim enables the user to have this level of accountability by defining locations for attachments, clips and labels; providing visual feedback on location, style and length; enabling automatic measurement of lengths in 3D, including a reference database of purchased parts for definition and details, and supporting unique details, such as zippers and elastic.

This enables you to store all details in a 3D master model for easy reference and manipulation. It also significantly improves the communication between design and engineering, reducing errors, enhancing speed-to-market and making for a more seamless process.

With all information and detail together in one 3D model, engineers can make design changes quickly and easily early or late in the development process and then efficiently share information with all engineering teams working concurrently on the seat system.

Mastertrim applies the manufacturing details necessary to accurately define how the part will be manufactured. This image shows how an attachment is defined on the seat cushion and the database attributes are assigned automatically.



2D pattern enhancement

Providing maximum flexibility for re-using data

Key functionality

- Formats patterns to be ready for 2D editing
- Imports patterns into empty model with no 3D definition
- Defines seam locations, pieces and attachments using only 2D patterns
- Automatically measures area, perimeter and lengths

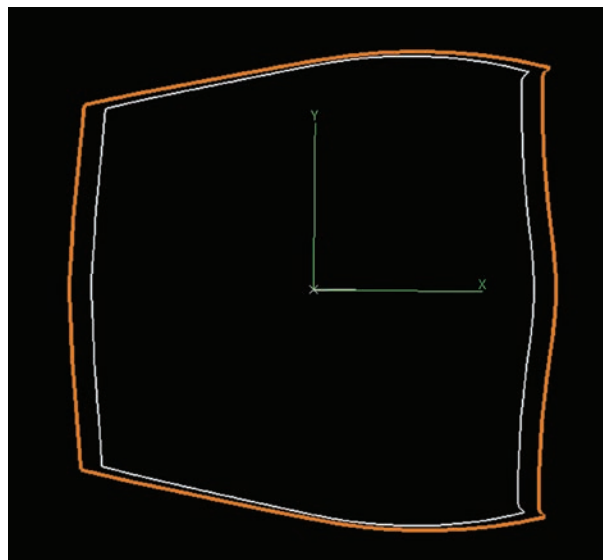
Benefits

- Provides two-way link between 2D editing applications and Mastertrim showing pattern boundary, notch definitions, piece attribute information and sew lines as individual curves
- Re-imports and re-links edited patterns so information generated by master model can be used
- Re-uses legacy data and brings into master model for later use

Patterns generated from the 3D surface may not be the final production patterns because aesthetic requirements are not built into the 3D model, and this can lead to the need for minor manipulation of the 2D patterns prior to production. In addition, trim engineering is often part art and part science so data from previous programs that were developed in a non-3D environment often need to be re-used.

Mastertrim enables the user to format patterns for 2D editing, import patterns into a CAD environment without a 3D model, define location pieces and attachments using only 2D patterns, and automatically measure area, perimeter and lengths.

This provides a two-way link between 2D editing applications and Mastertrim, showing pattern boundaries, notch definitions, piece attribute information and sew lines as individual curves. It enables you to re-import and re-link edited patterns so information generated by the master model, such as documentation and costing, can be used, and legacy data that has been brought into the master model can be re-used.



Aesthetic requirements often lead to the need for a minor manipulation of the 2D patterns prior to production. With Mastertrim, patterns can be edited and imported into the master model definition for downstream data.

Manufacturing documentation and automation

Providing single source of data facilitates manufacturing process

Key functionality

- Generation of DXF, AAMA and ASTM files that can be read directly into the cutting and nesting software
- Manufacturing operations are virtually defined and visually represented in CAD model
- Fields for notes and details provided to explicitly communicate process
- Manufacturing steps with notes and details generated in single or multiple page step-by-step sewing report

Benefits

- Changes can be easily made from a single source since manufacturing documentation and data are generated from the master model
- Provides interface with all major nesting and cutting software so existing applications can be used
- Saves time by automatically generating documents and data from a single source

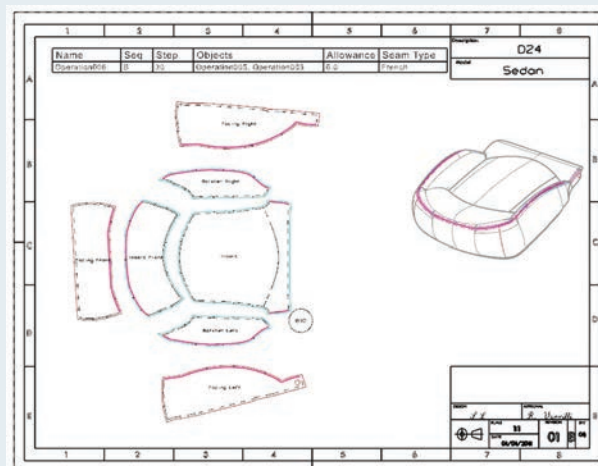
After the design definition has been communicated to manufacturing, the data has to be sent to the cutting and nesting machines. Currently, communicating manufacturing documentation so the process can be automated entails manually developing patterns and then creating an electronic file that can be read by the nesting and cutting software.

This methodology for communicating manufacturing steps is at best time-consuming, and at worst an impediment to competitiveness. Images of the prototype need to be generated and the physical seat needs to be sewn and captured. Videos are often made. All in all, it is a manual and expensive process.

By contrast, Mastertrim provides the ability to generate a variety of file types that can be read directly into the cutting and nesting software because the

manufacturing operations have been virtually defined and visually represented in the CAD master model. Fields for notes and details are provided to explicitly communicate the desired process.

Mastertrim provides interfaces with all major nesting and cutting software so existing applications can be used. Just as importantly, you save time because manufacturing documentation and data are generated from the master model which allows changes to be made easily since it all flows from a single source.



Mastertrim allows you to quickly generate customized sew documents for manufacturing that include 2D and 3D part and piece images, standard title blocks, diagrams and logos as well as tables and form elements that are automatically populated.

About Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Digital Factory Division, is a leading global provider of product lifecycle management (PLM) and manufacturing operations management (MOM) software, systems and services with over 15 million licensed seats and more than 140,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with its customers to provide industry software solutions that help companies everywhere achieve a sustainable competitive advantage by making real the innovations that matter. For more information on Siemens PLM Software products and services, visit www.siemens.com/plm.

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