CUSTOMER STORY

Technische Universität Dresden

Elbflorace Electric Formula Student Team

INSPIRE solidThinking

Image courtesy of ELBFLORACE

MICHAEL SÜß is a Research Fellow at the Technische Universität Dresden who is currently working on his PHD focusing on design guidelines for additive manufacturing/electron beam melting. In addition to this, Michael also works very closely with the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM. The Fraunhofer IFAM is one of Europe's leading research institutions in the fields of adhesive technology, material sciences, and manufacturing techniques.

When looking for a demonstrator to design as a portion of his research, Michael thought back to his time working on a Formula Student team. Michael noted, "I had a history of working on a Formula Student team and wanted to help the current team at the Technische Universität Dresden out. I asked the ELBFLORACE Electric Formula Student Team to suggest a volunteer who is currently working on their project thesis to collaborate with on this project." This is where Michael met Lucas Hofman, a current student at the Technische Universität Dresden.

Together, Michael and Lucas set out to find a current part on the car that made the most sense to be redesigned for additive manufacturing/electron beam melting. Ultimately the part selected for the redesign was the steering column mount. Lucas noted, "The current steering column mount had four different areas that were at different angles to each other, because of this, it was extremely difficult to produce with a 5-axis milling machine. The solution to produce this part consisted of four different milled aluminum parts that were all bolted together. We also discovered other parts that could ultimately be redesigned for additive manufacturing like the uprights, but we selected the steering column mount as we felt that with this part, we could make the largest performance and weight improvements."

INDUSTRY

Automotive/Formula Student

CHALLENGE

Design and manufacture a new Formula Student steering column mount.

SOLUTION

A process involving the use of solidThinking Inspire for design and electron beam melting for production of a new part that reduces design time, material and increases performance characteristics.

RESULTS

- Redesign of steering column mount to be produced with additive manufacturing (electron beam melting)
- Reduction in number of necessary parts from four to one
- 35% weight savings on steering column mount (330g down from 500g)
- 5x increase in stiffness on new part
- 50% reduction in overall design time
- 90% less wasted material with new manufacturing process

SOLIDTHINKING INSPIRE IN THE DESIGN PROCESS

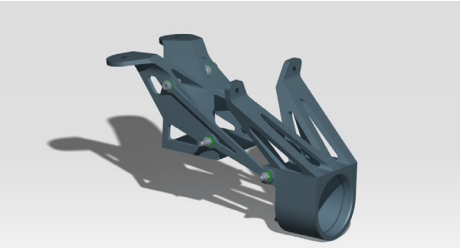
Michael and Lucas both learned about solidThinking Inspire in different ways. Michael was first introduced to Inspire at a workshop taking place at the international trade show, Euromold. Lucas was first introduced to the tool at a Formula Student workshop that his university was involved in. Both were immediately impressed with the ease of use of the tool. Michael noted, "I love how easy it is to use the PolyNURBS features, it allows us to quickly take optimization results and reconstruct the part so it is ready for manufacturing. In the past, this was always the most difficult part of working with optimizations. We no longer have to use multiple reverse engineering tools, we can now do it all within one tool, Inspire." Michael and Lucas also noted the usefulness of the integrated analysis tools in Inspire, which allowed them to simulate real world conditions on the part.

Knowing that the goal was to produce the part using electron beam melting, Michael and Lucas knew that they would have great freedom when designing the part. Michael noted, "Electron beam melting has a huge advantage over other manufacturing methods, it allowed us to be quite free with our design as there are very few design constraints." With the knowledge that both Michael and Lucas had of Inspire, they determined that it was the ideal tool to perform both the optimization, as well as refinement and final preparation for manufacturing. Lucas noted, "Inspire allowed us to determine the ideal material layout for the part and the PolyNURBS tools enabled us to get from the optimization to manufacturing extremely quickly. I would say that the entire part refinement process took only 5-7 hours, which is extremely quick."

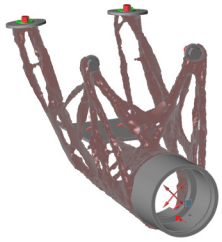
Once the part was redesigned based on the Inspire optimization results, the next step was to manufacture the part. The team worked with Franhaufer IFAM to complete the manufacturing. An Arcam A2X electron beam melting machine was used. Michael explained, "The build time on the part was about 29 hours and the part was produced with a titanium alloy. Electron beam melting was great for this process as you do not need as much support structure as you do with other additive manufacturing methods. Once post processing is complete, we expect the part to weigh 330g which is 35% lighter than the original part that was 500g. Without Inspire, the weight savings would not have been possible. Inspire and its PolyNURBS tools are quite impressive, it allowed us to move extremely fast from our optimization to the final manufactured part, we are definitely going to use Inspire more and more often in the future."

WHAT'S NEXT?

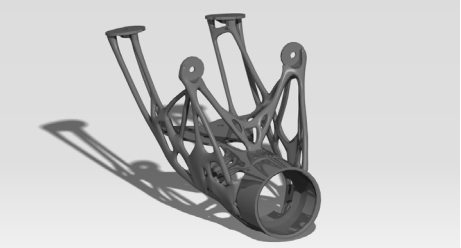
The new steering column mount is now in the post-processing phase. Michael and Lucas are hoping that it will be ready to be included on the Formula vehicle very soon. After their incredibly successful usage of Inspire including impressive weight savings and performance increases, both Michael and Lucas noted that they plan to use the tool more in the future. Lucas even noted that he plans to use it for his diploma thesis.



Original steering column assembly



Inspire Optimization of steering column



Rendering of new steering column after refinement with PolyNURBS

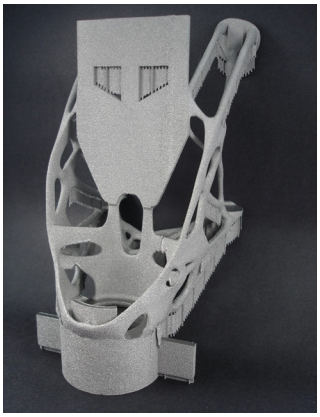


Image courtesy of Fraunhofer IFAM

New steering column prior to post-processing

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