

Race Face

Bicycle Hardware



Images courtesy of Race Face Performance Products

RACE FACE Performance products is a leading designer and manufacturer of performance cycling products. Based in Vancouver, B.C. Canada, Race Face has distribution in over 40 different countries. It specializes in performance cycling components, clothing, and protection. It has been in business for over 20 years.

When planning its next generation bicycle crank, Race Face set out to increase the stiffness of the current version crank arm, without adding any weight. The new crank also had to maintain strength targets. “Our constraints were to manufacture in a cost effective way that minimized tooling cost and processing of each part,” noted Race Face Senior Design Engineer, Chris Heynen.

“We assumed that our traditional 2D forging and machining process could not be optimized any further.”

Traditionally when designing new crank arms, Race Face attempted to maximize stiffness using an I-beam cross sectional design. Attempts were made to optimize the crank arm at the moment of inertial at various sections. From there, Race Face would run a finite element analysis, make changes and recheck until stresses were minimized for the desired shape and weight.

SOLIDTHINKING INSPIRE IN THE DESIGN PROCESS

After discovering solidThinking Inspire, Race Face realized that it could greatly enhance and speed up this design process by better understanding material placement within its designs. Race Face also quickly recognized that Inspire’s built in manufacturing constraints would help it to design for its 2D forging process.



INDUSTRY

Bicycle Hardware

CHALLENGE

Design and manufacture a bicycle crank with increased stiffness and strength targets, yet the same weight as the current aluminum alloy part.

SOLUTION

A process incorporating solidThinking Inspire to generate the ideal concept for a forged part.

RESULTS

- Concept generation in Inspire utilizing manufacturing constraints, symmetry and draw direction.
- Utilization of initial Inspire results to create a new design space for further concept generation and refinement in Inspire.
- Creation of forging tooling based on concepts generated in Inspire.
- Development of a new bicycle crank design that is 25-50% stiffer at the same weight as the original part.

To begin concept generation for the crank arm, Race Face first imported a very rough design space into Inspire and applied the materials and loading conditions, as well as a split draw manufacturing constraint. The concept generated in Inspire was significantly different than the I-beam architecture that Race Face had traditionally used.

“From these results I concluded that it was ok to minimize the area around the crank boss,” noted Chris, “so I refined the design space of my model before future optimization, removing all material not essential to the known end design. This decreased the overall starting design space.”

Race Face then used this updated design space to generate concepts for both maximum stiffness and minimum mass.

Chris then imported the concepts into his CAD program and used them to build a final design. Chris noted, “once completed, we created forging tooling based around the Inspire led design. The final creation is a crank arm that is 25-50% stiffer (depending on the test) at the same weight as the previous generation crank arm and much stronger. The increase in the yield strength is directly related to the increase in stiffness.”

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Using solidThinking Inspire for concept generation helped Race Face to greatly speed up its product design process while creating a uniquely designed product that is much stronger than its predecessor. Having the ability to generate ideal concepts before starting detailed design in CAD helped to decrease design iterations, while manufacturing constraints such as symmetry and draw direction helped the team to design a part that was ready to be manufactured using 2D forging.

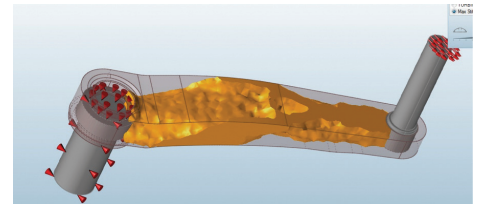
WHAT'S NEXT?

Race Face has seen the benefits of solidThinking Inspire for concept generation firsthand. Not only did it help them to create a bicycle crank arm that is stiffer than the previous generation, but also extremely uniquely designed. Moving forward, the Race Face team plans to continue to use solidThinking Inspire and hopes to reduce the weight of their designs even more.

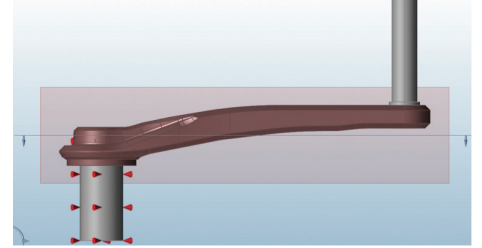
ABOUT RACE FACE

Based in Vancouver, B.C., Canada, Race Face Performance Products has been designing and manufacturing leading-edge performance cycling components, clothing, and protection for more than 20 years. They are a global cycling brand with product distribution in more than 40 countries and a roster of multi-disciplined professional athletes and organizations around the world. As a company of riders who design and test on North Vancouver's infamous 'Shore', you can be sure Race Face products have endured some of the most abusive riding conditions.

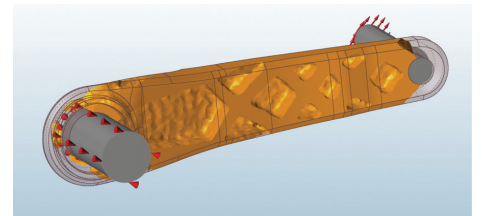
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Initial concept generated by Inspire



Updated design space based on initial concept generation



Maximum stiffness concept



Final forged part



Final product

