

LEGO® Defines Best-in-Practice Mold Design with I-DEAS® Freeform



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Torben Rasmussen
Design Engineer
LEGO Group
Denmark



I·DEAS®
freeform

Product

► I-DEAS Freeform Modeler

Application

- Freeform surface mold design
- Surfaces are created from curves on the computer or scanned data.

Situation

Founded in 1932, the international LEGO Group, headquartered in Denmark, is one of the world's largest toy manufacturers—employing approximately 9,400 people in 30 countries. From transformable playhouses to the famous building bricks, LEGO® products are known for their multitude of colors and sizes, exotic shapes, and unique styles. At the center of product development, LEGO Engineering is responsible for continually improving the design and manufacturing process for next-generation products.

LEGO Engineering implemented I-DEAS Freeform Modeler from SDRC to improve their product mold design process. By combining I-DEAS Freeform Modeler with their solid modeling CAD system, they were able to develop freeform surfaces in less time while maintaining the design intent. In fact, whether going directly from hand-made models into CAD or creating surfaces from curves on the computer, LEGO Engineering has found that new product molds can be designed two to three times faster than previous methods. “We have gone from months to design a product to approximately a few weeks,” claims Torben Rasmussen, LEGO design engineer. “Anyway, in all cases, that’s about a 50% time savings.”

LEGO implemented the full capabilities of I-DEAS Freeform Modeler when designing the mold for its latest toy—the LEGO Primo Cat. The most unique feature of this product was its flowing, freeform surfaces. Initially, LEGO Engineering attempted to model the complex surfaces in their CAD system.



*LEGO Primo Cat
clay model*

However, it was very difficult and time consuming to create the complex surfaces in a solid modeling environment. “After 300 person hours, we developed the product surfaces, but we were unable to capture the original design intent,” explains Rasmussen. “This prompted us to search for better alternatives for creating product surfaces that are required for the mold cavity designs.”

Using I-DEAS Freeform Modeler in conjunction with a scanning device to capture the digital representation of a clay model of the LEGO Primo Cat, the surfaces were then built over the digital model to create a complete freeform surface model. The entire process took approximately 20 hours. “Our team was able to prove a 15 times reduction in the mold design process; more importantly, we achieved the desired design,” states Rasmussen.

Today, with seven I-DEAS Freeform Modeler licenses and ten trained users, I-DEAS Freeform Modeler has become the tool of choice for bringing hand made models into CAD and for modeling freeform product surfaces that are very difficult to create in CAD.

In the first process, toy models are created in clay or PUR foam, scanned, designed in I-DEAS Freeform Modeler, then imported into the CAD system. In the second process, freeform surfaces are created directly from curves in I-DEAS Freeform Modeler on the computer. This capability has enabled LEGO Engineering to model complex

shapes such as human-like wigs and hair very quickly. Once the surfaces are complete, they are brought into the CAD system to be sewn into a solid. The solid element is subtracted into the mold form. If necessary, additional features like cooling water ejector pins are designed. Finally, the complete CAD design of the mold is delivered to manufacturing where the actual/exact geometry is then milled/spark eroded into a mold. Additionally, other technologies can be used to complement I-DEAS Freeform Modeler. For example, LEGO applies an application that is used to copymill directly from the point cloud data generated in I-DEAS Freeform Modeler. Also, if a physical prototype is required before manufacturing, LEGO Engineering can use I-DEAS Freeform Modeler's Rapid Prototyping Module (RPM) to transfer the model to LEGO's rapid prototyping machine.

With I-DEAS Freeform Modeler, LEGO can handle most complex, freeform modeling scenarios within a position tolerance of 0.0001 mm. Features like fit freeform, fit with cloud and curves, loft curves, blend with boundary curves, and merge, sweeps, and fillets, enable LEGO Engineering to model almost any type of surface that the product features demand.

In addition to creating mold models, LEGO elements are also stored in a database for viewing. These models are incorporated into LEGO multi-media and animation products that are developed by the LEGO Darwin Group.



"We have less limitations on our ability to develop freeform surfaces, so more complex models can be created in much less time," states Rasmussen. "Our tendency is towards more freeform surface designs in all LEGO brands, so use of I-DEAS Freeform Modeler will most likely continue to grow."

Results

- ▶ 50% time reduction in product mold design
- ▶ Achieved the true design intent.
- ▶ More complex molds are designed in less time.



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