Injection molding simulation software makes for better parts, process

By Clare Goldsberry
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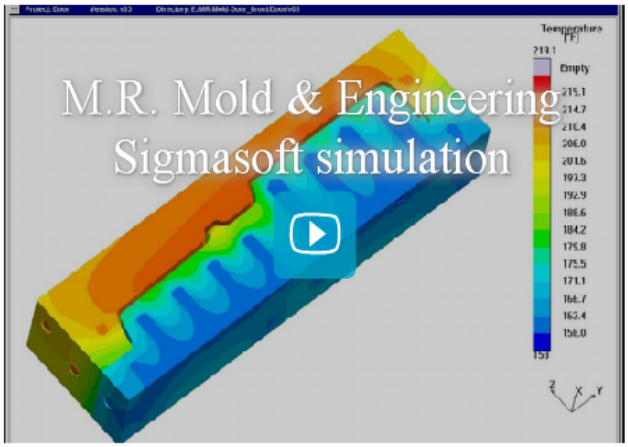
Sigmasoft, maker of molding processing analysis software for thermoplastics, thermosets, elastomers and silicones, and MIM and CIM, has awarded its first "Industry Expert" award to Torsten Kruse, owner of Kruse Analysis. Kruse's background includes working for injection molding machinery manufacturer Arburg from 1986-1995 in the customer molding process development, where he attained his expertise in molding, materials and tooling.

As he became more knowledgeable in plastics processing he went into flow simulation, and started his own company in 1995. He began using a material processing analysis software in 1995. In 2001 after seeing a demonstration of Sigmasoft at the K show, Kruse was impressed. "I was using a different software at the time, but I clearly identified what simulation software should provide. Sigmasoft was way beyond anything I'd ever seen," he states. "I had the pleasure of working with Sigmasoft for several years prior to their opening their own North American office. I have been using the Sigmasoft software ever since."

"Pretty awesome"

Rick Finnie, president of M.R. Mold & Engineering, remarks that the Sigmasoft molding analysis software is "pretty awesome," and does what it does "on a higher level than currently exists by using a 3D mesh."

Sigmasoft molding analysis software takes the model and breaks it into tiny elements and runs the mathematical calculations to determine a vast variety of processing results. "We've used it a few times and it's amazing what it can tell us," Finnie says.



Kruse notes that if the analyst doesn't know the materials and the molding process, "they can make lots of mistakes that lead to incorrect results, and this can leave a bad taste in the mouth of the client," he says. "The good analyst will create the simulation and point out to the customer what it takes to create a robust design both from a part design perspective and a mold design perspective."

Material flow software often gets a bad rap for a couple of reasons. First, notes Kruse, there's reluctance on the part of the moldmaker to share details, and secondly, there's also a reluctance of people to believe the results of the analysis.

Sink marks and a 60-second-plus cycle

Currently, Rick Finnie is working on a thermoplastic injection molded part (M.R. Mold & Engineering is also known for its expertise in liquid silicone rubber (LSR) molds). The product is a secure lock box for the medical industry that requires tamper proofing.

"The door is a highly visible part, so a direct sprue gate couldn't be used, which would be the usual choice," explains Finnie. "The second choice was to put the gate at the end of the door, but that would have required a 10-inch runner, so we had concerns with a side edge gate. There were just a lot of issues so we chose to have Kruse Analysis do a filling analysis for us."

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"The analyst sometimes doesn't get all the information they need to do the best job he or she can," Kruse says. From Kruse's point of view, the analyst needs to be the best communicator he or she can be. They need to have the ability to ask for details from the client, getting all the information that they need to do the job. After they do the analysis, they must then go back to the client and convey all the details of the results, help the client to understand the limitations and the boundaries of the part, the mold and the material.

"We show them the how to interpret these results of the analysis," Kruse says. "There is no 100% correct solution. The analyst's job is to ask for the details, do a detailed analysis, and then provide a detailed explanation of the results, and explain carefully what the results mean. I see this every day - the approach of using simulation software is so misused in a lot of instances because the analyst doesn't get enough detail or doesn't ask for the details. It's all about the details. Details are the most important thing. If you take care of the details, everything else will fall into place."

Kruse notes that it is important to remember that material flow and mold analysis software is "a tool to evaluate the part, the mold design and the process. If you don't know the process, you can't provide good analytical information or you might miss a point and recommend something that's not possible."

It's also extremely important that analysts cover all their bases and know machines, tooling and materials - the materials side of the simulation being the most important," stresses Kruse. "You need to understand materials in-depth because if you don't understand the material behavior you can't understand what should happen in the mold and what needs to be done to improve the process to make a quality part and a robust design. "If you don't have that clear vision, you set yourself up for failure. It's not just about knowing how to run the software; it's what you know about the machinery, the materials and the processing."

Initially Finnie thought the gate location he chose was "a terrible location" but the wall thickness at that site allowed the part to fill without flow or knit lines. The analysis also showed that the gate and sprue were freezing before the part was fully packed. Finnie's team redesigned the gate and sprue.

Additionally, the customer had added a tamper-proof feature onto the side walls that resulted in portions of the wall being .250 thick. "That was problematic because the analysis showed probably sink marks and a cycle time of 60-plus seconds," Finnie comments. "We went back to our customer and suggested they make design changes to eliminate the thick wall sections. They improved the design and Kruse re-ran the analysis. With the simulation results, we were able to shave 15 seconds off the cycle time."

Kruse did a warp analysis because the part looked as if that might be a problem and Finnie was in the middle of building this tool. "We needed to know at that point if what we expected would happen during molding process would actually happen."

Finnie was also concerned that the gate in the middle of the part might result in part warpage. "We needed to know at that point if what we predicted would happen during the molding process would actually happen. Some part warpage is to be expected but we wanted to use the analysis to determine how severe it might be," added Finnie. "Kruse did a warpage analysis, and results showed that warpage would be well within tolerance."

Finnie notes that in his experience with Kruse Analysis, Torsten Kruse is extremely knowledgeable in plastics and the injection molding process from his years of working at Arburg. "That's key to Torsten's expertise in performing material processing flow analysis," he adds, noting that he was in a Sigmasoft users group with Kruse when one thing became very apparent: "If you've never molded a plastic part you have no business operating this software."

Sigmasoft calculates a multi-stage analysis in which you can tell the software to run the analysis 25 simulated cycles while performing a thermal analysis of the steel to see what happens within each cycle. For example, an analysis of a 1-minute cycle vs. a 45-second cycle, will enable us to see how hot the steel will get when you put 400-degree plastic into the mold every 45 seconds.

"The software allows you to pick as many cycles as you want, and at some point the steel will reach a steady state. But, if you don't know how to operate an injection molding machine, you'll never get it right," comments Finnie. "Anybody can punch numbers in and come out with an answer, but it's a bogus answer. Torsten puts in accurate information to get accurate results."