MODEL COMPANY

An award-winning consulting firm uses simulation to help small companies — and itself — grow.

By *ANSYS Advantage* Staff

Exventys is a small consulting company with a mission to bring simulation technology to small and medium-sized companies that are not familiar with simulation or do not have the capabilities to use it on their own. The consultancy applies unique thought processes to the insight gained from simulation to come up with innovative product solutions. *ANSYS Advantage* interviewed Samir Osmani, technical manager of Exventys, based in Saint Quentin, France.

Samir Osmani, Technical Manager, Exventys

HOW DOES EXVENTYS HELP CUSTOMERS REACH PRODUCT DEVELOPMENT GOALS?

The typical Exventys customer has 10 to 100 employees; though they have extensive expertise in designing their own products, they do not have internal capabilities to perform simulation. These companies are often short on funding, or, if they are well funded, they are unwilling to make the investment required for an internal simulation program. As a result, we have pioneered an unusual risk-sharing method of compensation. Instead of charging for the time we spend on the project, we charge the customer for the benefits they receive. For example, if the project goal is to develop a new product, Exventys is paid a percentage of the sales of the final product for one to three years.

WHEN YOU FIRST TALK TO CUSTOMERS, WHAT METHODS ARE THEY USING TO DESIGN THEIR PRODUCTS?

Our customers have often been working for decades in one specific product niche. When they bring a new product to market, they focus on what has worked well in the past — suggestions from customers and employees as well as ideas based on competitors' products, for example. These companies typically build a prototype and then come up with some ideas to tweak its performance. In most cases, customers do not develop completely new approaches to the problem. Once these companies have established their basic conceptual design, they do not explore all of the possible alternative detailed approaches to find the one that's the best. When working with physical prototypes, it is far too expensive to try off-the-wall approaches or to truly optimize the design.

ARE YOU ABLE TO HELP THESE COMPANIES IMPROVE PRODUCTS EVEN IF YOU ARE NOT EXPERTS IN THEIR FIELD?

Exventys has an approach that enables customers to evaluate a much broader range of design alternatives than would be possible without simulation. We usually start by modeling the existing design. Then we perform a simulation and compare the results to physical testing of the product to be sure we have not overlooked something basic. Then we begin to examine different approaches. We ask our customers for ideas they could never afford to prototype, whether because of time or money. I provide ideas based on my 20 years of engineering experience, primarily working with rubber and plastics. Using simulation, we evaluate these ideas quickly and inexpensively. Most ideas don't turn out to be winners, but by evaluating many ideas, we almost always make a substantial improvement on the original design. We show our customers the value of using simulation systematically, especially early in the design stage.

CAN YOU PROVIDE AN EXAMPLE?

We worked with a customer who builds machines that use an Archimedes screw to move grapes during processing. This device consists of a screw inside a hollow pipe; when the screw is turned, it transfers materials up the screw and out the top end of the pipe. The Archimedes screw is used in a wide range of processes to move liquids and solids. The customer was happy with the performance of the existing screw but wanted to reduce costs related to its steel construction. The complex geometry made it very expensive to machine.

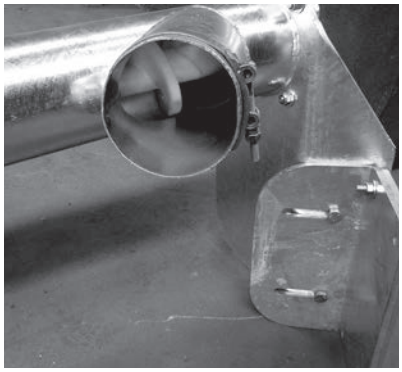
It was obvious that the screw could be made for a considerably lower cost if molded from an elastomeric polymer, but this would require ensuring that the polymer screw held up just as well as the steel screw. I saw an opportunity to not only improve the customer's product but to make an Archimedes screw that offered an advantage in many different applications. The idea was to divide the screw into flights, each consisting of a single

The Exventys screw design won an Innovation Award from the French Rubber Manufacturer's Association and the French Association of Rubber and Polymer Engineers.

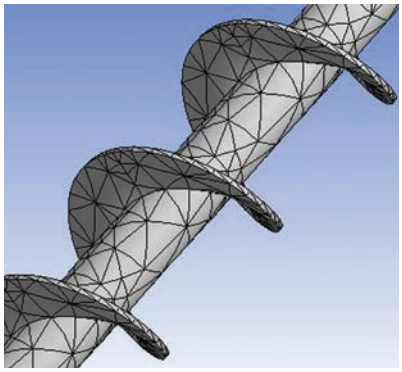
helical revolution. This would make it possible to mold the flights in volume to reduce cost. The flights could be combined to make Archimedes screws in any length needed by a user. A key advantage is that if the product becomes worn or damaged, the user can repair it simply by changing a flight. But this idea considerably increased the product's mechanical requirements, particularly for diameters from 1 inch to 6 inches, which are the most popular. The challenge was to make a plastic screw with the same efficiency as the steel screw while ensuring that the plastic screw was within acceptable stress and deformation limits. This is where simulation came in.

WHY DID YOU SELECT ANSYS MECHANICAL FOR THE SCREW PROJECT?

I have tried many finite element software programs over the course of my career. I find that ANSYS Mechanical software is the easiest to use and provides the best correlation with the real world. I also like the fact that ANSYS offers a wide range of simulation tools within the ANSYS Workbench environment that cover thermal, fluid flow, electromagnetics and other types of simulations.



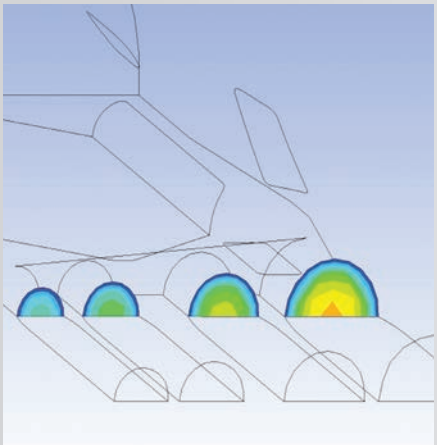
Archimedes screw



FEA model of original steel screw used to validate simulation process

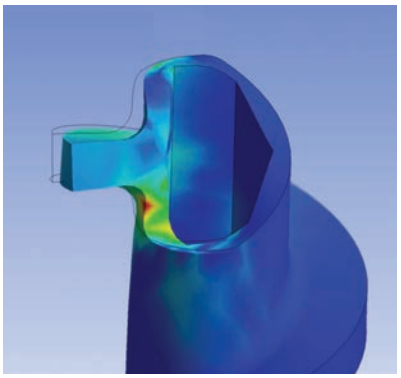
HOW DID YOU DESIGN THE FLIGHT USING SIMULATION?

I performed static analysis on many different geometric iterations. I tried several plastic materials using the design exploration capabilities of Workbench until I found a combination that delivered the right performance while providing the physical properties needed to survive this application. During the analysis process, I looked closely at stresses in the plastic screw to make sure there was no local damage to the material. I also examined the connection between the shaft and each flight. After I was satisfied with the design's mechanical performance, I performed modal analysis to ensure that the selected design did not have a resonant frequency that would be excited during operation.

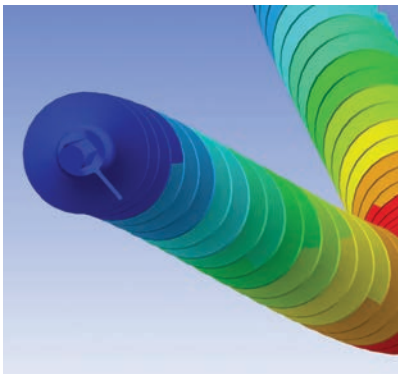


Solving a Problem with a Rubber Extrusion Die

Utilizing simulation to solve customer problems, Exventys worked with a manufacturer that had been trying for a year, without success, to extrude a rubber part at the appropriate extrusion speed. Exventys simulated the die using ANSYS Polyflow computational fluid dynamic software. The simulation showed that the pressure drop in the die was too high; it indicated that the 500 mm length of the die was the root cause. After numerically evaluating a number of different designs, the engineering team concluded that a new 50-mm-long die design would solve the problem. The use of ANSYS Polyflow allowed what-if scenarios to be studied using simulation, so cutting physical dies for each design was not required. The new die exceeded the customer's performance targets by 50 percent, and the rubber part is now in production.

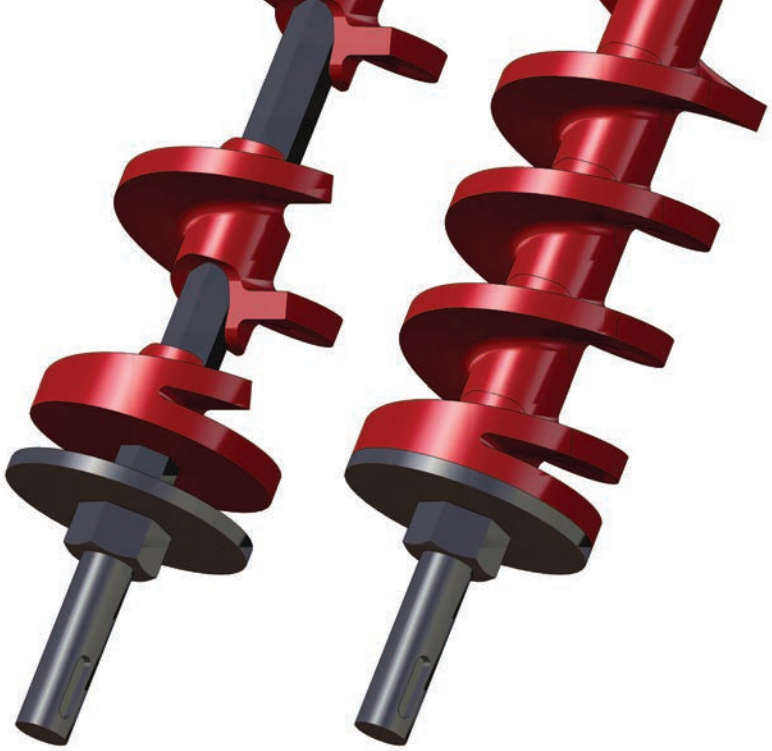


Simulation results show stresses on a polymer flight.



Modal analysis results for polymer flight

Exventys received a rubber industry innovation award for its Archimedes screw design.



CAD model of final Archimedes screw design

WHAT ARE THE ADVANTAGES OF THE NEW ARCHIMEDES SCREW?

The cost of the device is lower because the screws are less expensive to build. The flights can be produced in volume and assembled by the end user to make the finished screw quickly and easily. Delivery time is much faster: Currently, customers who order Archimedes screws have to wait a month for a custom screw to be produced to their specifications. But now we can send them standard off-the-shelf flights that they assemble in 30 minutes. The plastic flights provide superior resistance to corrosion, abrasion, acids and bases. The flights have less friction, which reduces the amount of energy needed to drive the screw and eliminates the need for intermediate bearings in many configurations. The plastic flights generate much less noise than steel screws, which helps to improve working conditions. The new product won an Innovation Award in Rubber and Plastic from the French Rubber Manufacturer's Association and the French Association of Rubber and Polymer Engineers (AFICEP).

WHAT'S THE NEXT STEP FOR THIS INNOVATIVE PRODUCT?

We obtained full rights to market the Archimedes screw from our customer. We are currently working with CDMO tooling and EMT Rubber, companies that provide invaluable support to Exventys, to create tooling needed to build their standard modules. We have patents pending in the United States and Europe. We are looking for partnerships to produce and market the product globally. We already have several customers up and running with the product. Our goal is to become the world leader in the business of moving bulk materials via polymers — in an area that was once reserved for steel. In the current economy, we can't just simply do our best, we need do more with less — what ANSYS calls amplifying engineering. This is what engineering simulation is helping us to achieve.