STAMPACK

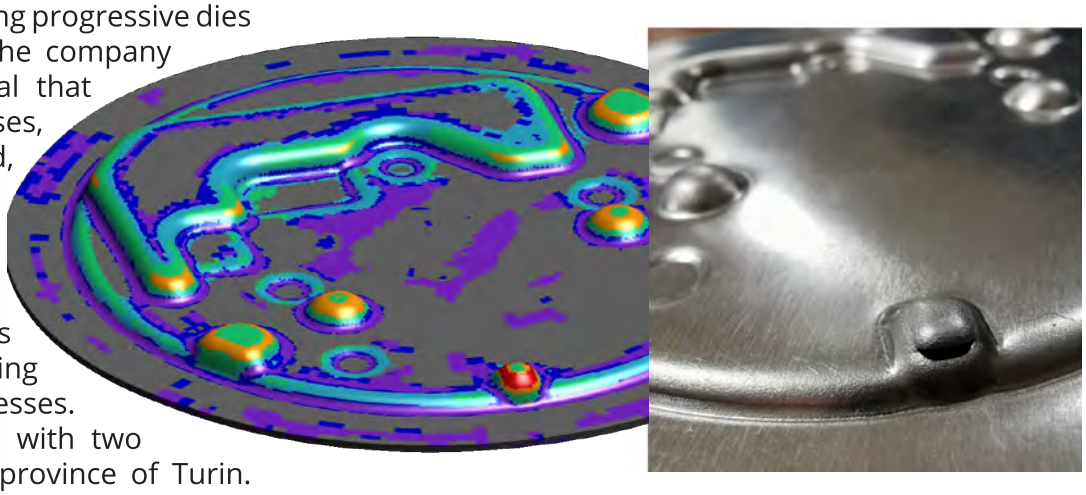
FORMING SIMULATION

Case Study
Sacel Group SRL

- Proving out designs prior to the tool build -

The introduction of the Stampack forming simulation software for sheet metal forming, into the quotation and tool design workflow has enabled Sacel to optimise its processes, increase its competitiveness, and reduce costs, as well as minimising tool trials, material waste, and energy consumption.

Sacel has been a leading player in the stamping industry for over 45 years, specialising in plant design, construction and production. Using progressive dies developed and built in-house, the company can stamp any type of material that can be laminated on its presses, including steel (untreated, pre-galvanised, pre-tinned, and stainless), copper and its alloys, aluminium and its alloys, and titanium. Sacel can now offer complete, tailor-made solutions for developing and implementing complex production processes. The company is based in Italy, with two main sites in Piedmont, in the province of Turin. "The Ozegna site", explains company director Raffaella Caretto, "is responsible for process development, including R&D, the technical department and the mechanical workshop." The latter is equipped with modern 3- and 5-axis milling machines featuring automatic pallet feeding, as well as lathes, wire and die-sinking EDM machines, and grinding machines — just to name a few of the most important technologies. The San Giorgio Canavese plant, on the other hand, comprises a sheet metal stamping department with around 20 presses ranging from 5 to 500 tons, and a plastic injection moulding department with 12 presses of up to 150 tons. These are mainly used for the automatic plastic overmoulding of stamped parts. The same plant also houses facilities for washing, degassing, laser welding and assembling the manufactured parts. Sacel also opened a production site in Slovakia 15 years ago. Here, the company can carry out sheet metal processing with presses of up to 630 tons, as well as plastic injection moulding production of up to 380 tons. The site is also equipped with laser and spot welding machinery, tumbling equipment, and washing and degassing facilities. In short, Sacel offers expertise and a wide range of technologies for a variety of industries. The automotive sector is undoubtedly worth mentioning, but the industrial and medical sectors are equally important, with various types of metal and polymer products manufactured for them.



New methods of providing quick and reliable answers

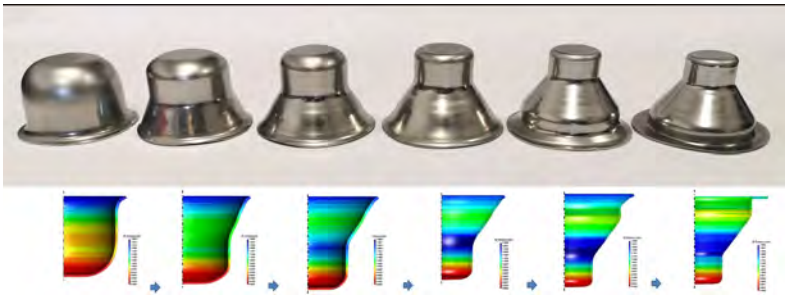
Sacel offers its customers the best solution for the required complexity and precision, providing an ever-higher technical level and uncompromising technical support. This is particularly true in the initial phase of a project, when working closely with the customer during the definition phase of the parts to be manufactured and subsequently when determining and fine-tuning the production process. "In the field of design in particular," says Luca Calcio Gaudino, Head of Research and Development, "there was a need to provide customers with quick and reliable answers to questions about the feasibility of parts with increasingly complex shapes and ever-higher precision requirements by introducing new methods in the initial study phase of the process." The use of finite element analysis to predict the behaviour of metals under defined stress conditions imposed by the plant enables the simulation of material behavior and the final result of the deformations imposed on the parts during the forming process. This approach clearly meets the need to reduce lead times, prototype manufacturing costs and the time/costs involved in completing the production process.

From virtual to real

"The introduction of simulation software for sheet metal forming in the technical office," says Luca Calcio Gaudino, "stems from the need to support the designer both in the quotation phase and in the product/process design of sheet metal components. This gives us early information to support the designer's ideas and assumptions before the tool is manufactured. By using the simulation results, we are able to check the feasibility of a component and its conformity with the customer's specifications in advance. The simulation provides the designer with information about the entire method and enables us to optimize the CAD process/method. The inclusion of simulation software in the design phase," confirms Luca Calcio Gaudino, "has also led to a 'changed approach to the design itself' for us, as it is carried out in parallel and in conjunction with the simulation phase. In fact, customers are increasingly proposing complex shapes that are not always feasible, as well as increasingly stringent requirements that must be met. For this reason, simulation results can be used, especially in the quotation phase, to quickly, easily, and effectively clarify feasibility issues for the customer or to propose and agree on changes. In addition, it can be proven that a certain required component geometry is not feasible, objectively through the visualisation of the simulation results and no longer just through 'word of mouth' based on experience."

Added value that translates into greater competitiveness

The forming software used in Sacel's technical department is Stampack. This is a virtual simulation environment for sheet metal stamping processes for deep-drawing, step and transfer tools for components made of various materials. "From a design perspective", emphasises Luca Calcio Gaudino, "Stampack, as already mentioned, is very useful for validating the method adopted by the designer. In addition, it is often very important to understand how the sheet metal behaves during and after each individual process step and how the formed part reaches the next forming station. The simulation provides a clear representation of the deformed part at each stage of the sheet metal position." Thanks to the extensive material library available, Stampack allows Sacel to assess the feasibility of parts to be made from new materials or whose formability is unknown. This added value translates into greater competitiveness that can be developed and passed on to customers.



Shell and SOLID simulation in one environment

Giovanni D'Ambrosio confirms, "Stampack's simple, clear and intuitive user interface is one of its most popular features." It enables users to set up simulations quickly without losing sight of the forming process, rather than focusing on setting up simulations from a numerical point of view in the pre-processor environment. In addition, the softwares structure allows for a step-by-step simulation of the process, just as with a progressive or stage tool. Another strength that Sacel appreciates, and perhaps the most important one, is the solid simulation, which volumetrically represents the moulded part (and not just a skin). Taking into account phenomena occurring in the direction of material thickness is of fundamental importance, especially when dealing with small/medium-sized sheet metal parts, i.e. when material thickness is not negligible. For the parts that Sacel manufactures, Stampack's ability to perform simulations that are not just of the shell type was a real breakthrough.

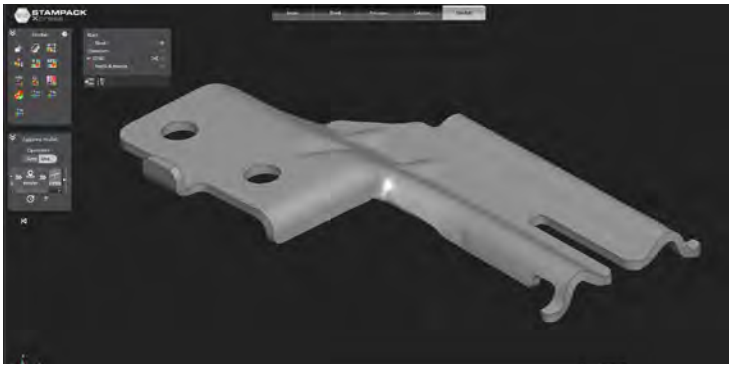
"The results achieved with this type of simulation", confirms Mr. D'Ambrosio, "are truly satisfactory, both qualitatively and quantitatively." Furthermore, some processes are not feasible with 'traditional' shell simulation, such as embossing, whereas they can be handled without any problems with solid simulation. Being able to use both shell and solid simulations in a single working environment is advantageous as it allows you to easily switch between the two depending on the requirements and the type of parts and dies to be simulated.

Thesis confirms the quality of the data and the accuracy of the simulation

For deep-drawn parts, solid simulation provides valuable support for optimising the manufacturing process, and helping designers determine the most effective method. The simulation clearly and reliably analyses the thickness of the deep-drawn component at each hammer position, highlighting the risks of thinning, breakage, or excessive material accumulation.
Giovanni D'Ambrosio adds, "Based on data from hammer reports and mesh creation, we found that the simulation results were highly accurate. Validation studies comparing deformations, defects, and final dimensions between real and simulated components were carried out, and the results were always positive and satisfactory. These results confirmed those of the simulator's first validation phase, which included a thesis by Giovanni D'Ambrosio. A student at the Polytechnic University of Turin, underlined the quality of the results provided by Stampack by comparing them with formed component. Another interesting feature of the software is the rendering of the part. This makes it possible to visualise defects and surface marks caused by the forming process in the simulator's graphical environment, thus highlighting any aesthetic problems with the formed part."

Designers and simulation software working together

In summary, it can be said that the accuracy and reliability of the simulation certainly depend on the input data and the process/method structure, but if the input data is implemented correctly, the results are truly satisfactory, and the Stampack interface facilitates this phase. Stampack can be understood as a virtual press that makes it possible to verify and validate the method a priority (before the die is manufactured), significantly reducing the costs of die tryouts and press set-up. What you get from the simulation is the result of a process defined by the designer, and the software 'simply' simulates what has been entered as input and delivers results. It is then up to the designer to make the necessary considerations and think about how to correct the process based on the results obtained. For these reasons, the designer always remains the central figure in the design process, while the software is a valuable support tool for the designer.



"The introduction of Stampack in mould making and quotation preparation," says Luca Calcio Gaudino, R&D Manager, "has enabled us to optimise the process and increase our competitiveness in the market by reducing costs, die testing, material, and energy waste." Increased competitiveness in the market means that Sacel can consolidate its presence not only within national borders (sales account for almost 50 percent of turnover, which amounted to around 30 million euros last year), but also in Europe and the rest of the world. In this context, in addition to its Italian production facilities and the plant in Kosice (Slovakia), Sacel also has a logistics center in Mexico, which is of strategic importance for serving customers in the vast American market.