

Solving a Pressing Problem

Invernizzi Presse Gains Precision and Safety with VPD Tools



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Customer:

Invernizzi Presse, Pescate, Italy
www.invernizzi.it

Software:

MSC.Marc®, MSC.Patran™

Summary:

The Italian manufacturer Invernizzi Presse employed MSC.Marc and MSC.Patran to improve existing presses and to develop new custom-made presses. They also used MSC.Software tools to illustrate the functional performance of the presses to their customers. The combination of MSC.Marc and MSC.Patran was used for various contact analysis, mechanical safety structure analysis, and load calculations. Invernizzi engineers could try more design variants in less time and gained more accurate results than by using traditional mathematical calculation methods. As a result, Invernizzi realized significant time savings, and, while optimizing material usage, saved production costs.

With more than 40 years experience in the construction and development of mechanical presses, the manufacturer Invernizzi Presse from Pescate LC in Italy produces some of the safest and most technologically advanced presses offered on the market today. In addition to their standard mechanical presses, Invernizzi Presse offers custom-made presses designed and built to meet the needs of individual customers. Invernizzi's broad product portfolio, high-quality materials, and technological expertise meet the industry's stringent requirements for safety, robustness, functionality, versatility, and durability.

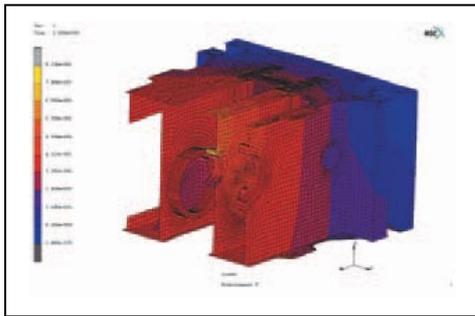
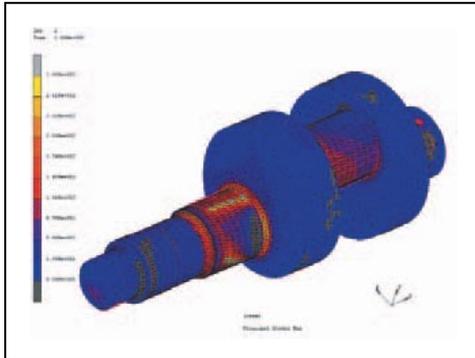
About five years ago, the company performed a benchmark of different finite element method (FEM) software packages to find the best analysis tool. “I studied the principal providers of FEM software,” says Luigi Piccamiglio, an engineer in the research and development department at Invernizzi Presse, “and decided on MSC.Marc because it is the best solution for our cases. We needed to study an assembly of parts that are in contact with one another. MSC.Marc is a very good product to study contacts and the thermomechanical behaviour of these parts.” Another reason Piccamiglio chose the MSC.Software product was its pre-processor, MSC.Patran. “We use MSC.Patran for meshing the models and it fits perfectly with MSC.Marc.”

Applications and Customization

Invernizzi Presse now uses the combination of MSC.Marc and MSC.Patran in a variety of applications, including:

- Contact analysis between pivot, bearing, and connecting rods to evaluate the flex/bending stresses in the pivot, the contact pressure on the bearing, and the resulting rod stiffness.
- Contact analysis between the presses' pivot, bearing and rod, along with the backlash of the pivot, in order to understand the thermo-mechanical behaviour of the bearing. Invernizzi engineers found that the heat generated by the friction between the parts increased the temperature of the mechanical components, breaking the oil film and seizing the mechanism. With this knowledge, the design was modified to improve performance.
- Mechanical safety structure analysis. The MSC.Marc model allows engineers to study the mechanical behaviour of the safety system used on all types of presses. The analysis uses flexible contact elements and an external force representing the oil pressure.

*"With MSC.Marc ...
I can try more design
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- Epicycloidal analysis (study of a multi-stage gear transmission system). This simulation allows Invernizzi engineers to evaluate the stresses in complex gear systems in order to optimise the gear dimensions, avoid gear failure during duty cycles, and extend the life of the mechanism.
- Load calculation during the bending process in order to understand the correct force needed to obtain the correct bending of the material.

Using the results of these simulations, Invernizzi can demonstrate the functional performance of a press without having to build a physical prototype, illustrating to its customers that the press will fulfil the requested tasks. This is especially important when a custom-made press is needed, since the production of a physical prototype would be impossible due to cost and time restraints. In

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addition to showing customers virtually how the press will work, suggestions for custom-made presses can be based on the analysis results provided by MSC.Marc and MSC.Patran.

"When we make a proposal to a customer, we include images of the FEM analysis to demonstrate the development," Piccamiglio says. "In addition, we specify that we use MSC Software products to develop our presses. The images are very useful, because they help to convince customers to buy our products."

Precision and Safety

Before using MSC.Marc, the development department of Invernizzi Presse used mathematical methods to do the calculations for the presses. These methods were time-consuming and less precise because only a certain number of design variations could be tested. "Manually, we could not study the parts as precisely – we spent more time and had less precision," states Piccamiglio. "With MSC.Marc we not only save a lot of time, but the precision of the calculation is a lot better since the FE method is more accurate. Now I get good precision on the parts I study and can try more design variants in less time."

Piccamiglio notes that another advantage of FEM with MSC.Marc is that it is easier to select the right material and material structure for each type of press. Different analyses with different materials can be performed easily and help to choose the best type of material in less time. "The virtual product development approach with MSC.Marc offers us many possibilities," Piccamiglio explains. "We can change the geometry of the coupling and the material characteristics. Since we can choose different types of material, we could, for example, cut and optimize the weight of one machine. Using the analysis results, we can reduce the weight of the structure and the thickness of the sheet metal which we use to build the parts of the press, and therefore significantly save costs on production."

Safe operation of Invernizzi's presses is another critical reason supporting the use of simulation. "Recently we did a thermomechanical analysis on a particular press because its high speed could have increased the temperature within the connecting parts of the press and the bearing," Piccamiglio

says. "A very high temperature in this joint can cause big problems. If there is contact between the pin and the bearing, it is a very dangerous situation for the press and its operators."

In another case, Piccamiglio studied a security system for a press. "This security system is very important, because if the press is working with a force higher than the nominal force, this security system can interfere and stop the press. If not stopped on time, the press might break and not function as predicted," he explains.

Expanding VPD

Piccamiglio is convinced that Invernizzi will continue using MSC.Marc and MSC.Patran, and possibly other MSC Software products. "MSC.Marc gives us confidence in our results and offers a complete list of features. I am very satisfied with the results of our analyses, and our collaboration with MSC Software has been a fruitful one," he says. "We might also look into dynamic simulation with MSC.ADAMS to study and optimize the link-drive mechanisms. I expect the integration of MSC ADAMS and MSC.Marc will bring many advantages to our development process."

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