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Andron Handling uses Altair SimSolid in design development of bespoke mechanical equipment

Design study 1 | Structural 1 - Overall
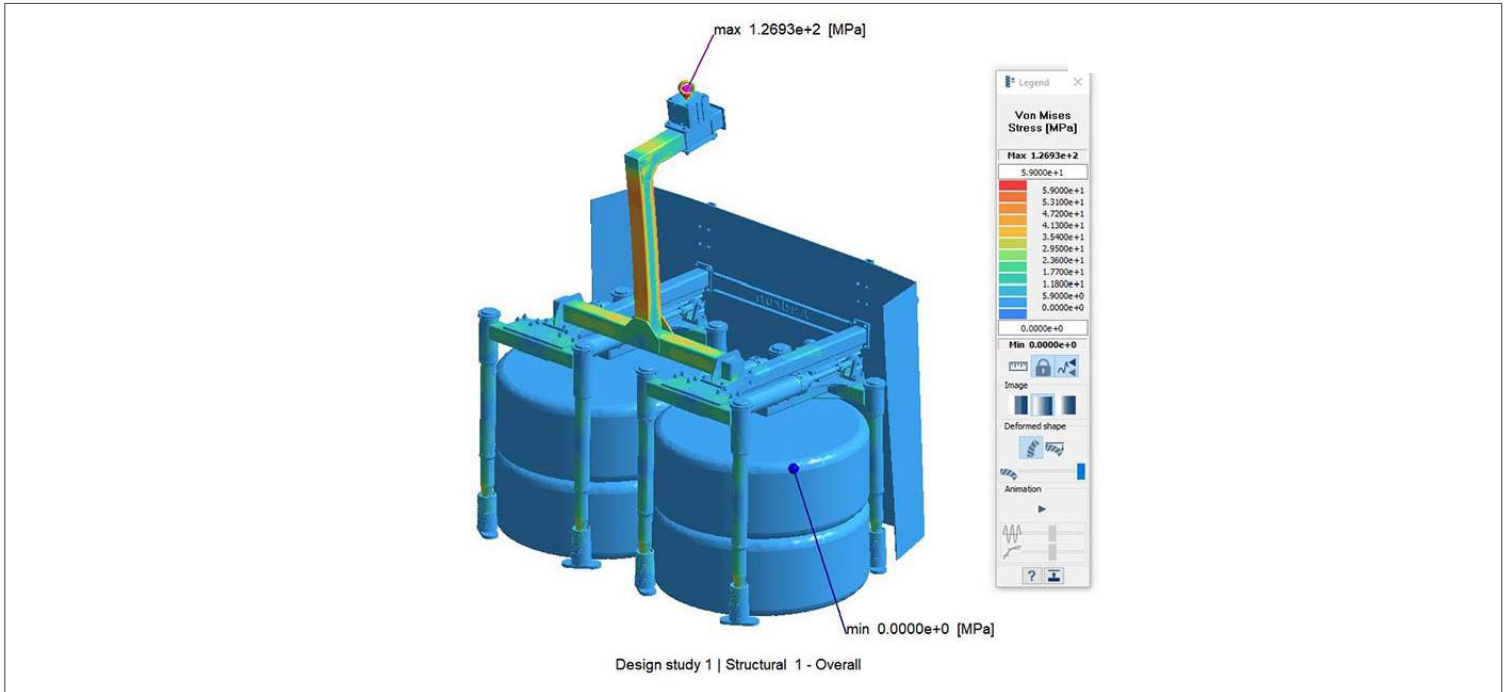
Andron Handling Ltd. is a U.K. based company specializing in the design of bespoke mechanical equipment. Most systems are one-off and are designed for a particular application. With mechanical, electrical, ergonomic and control system expertise, Andron is able to take on any handling requirement.

Currently Andron is developing a bespoke handler for a major automotive supplier. The handler transfers wheel sets from a conveyor system to delivery pallets with tight space constraints. A pneumatic clamping system is used to grip up to four wheels at a time, allowing rotation of the wheels while clamped.

Andron needed to assess the strength of the welded fabrication and vertical clamping arms for both lifting and clamping loads. In previous analysis of this type in Altair SimSolid™, Andron would have removed the wheels from the model and applied reaction forces at the bottom of each of the clamp arms. In this case Andron used a different approach that would not have been possible with previous FEA toolsets.

In this approach the full assembly is modeled. Clamping forces are simulated by applying a force to each of the four piston rods and a matching reaction to each cylinder body. Sliding connections are applied to the piston and linear bearings to allow this force to be transferred to rigid bodies simulating the wheels.

No special preparation of the model was required; the analysis includes small components such as circlips and fasteners. The only modifications from SimSolid's default settings were to use increased quality for automatic contact detection, adjust a few of the resulting contact conditions to simulate the sliding of the pneumatic cylinder and linear bearings, and set the wheels models as rigid bodies in order to assign a fixed mass.

Andron Handling

Industry
Mechanical Equipment

Challenge
Assess the strength of the welded fabrication and vertical clamping arms for both lifting and clamping loads for the development of a bespoke handler.

Altair Solution
Using SimSolid to model the entire assembly with sliding connections, a clamping force on the pistons and matching reactions on the cylinder bodies.

Results
• Reaction forces at the lifting eye found to be within 1.5% of theoretical weight
• Simulation of full assembly in less than 50 seconds, allowing multiple design iterations
• Stress values well within limits, giving a predicted safety factor in clamping arms of 8,7 against yield

Reaction forces at the lifting eye are found to be within 1.5% of theoretical weight calculated in SOLIDWORKS. The figure in SimSolid is likely to be more accurate than SOLIDWORKS as measured weights have been applied to purchased items, e.g. linear bearings and cylinders.

Figure 3 shows the predicted displacements due to gravity. The full assembly had 530 parts, with a simulation time of less than 50 seconds. This speed allowed Andron to run multiple design iterations in the budgeted time.

Figure 4 shows a detail view of the stress results in the clamping arms. Stress values were found to be well within limits, giving a predicted safety factor in the clamping arms of 8.7 against yield.

Figure 1 – Clamping force applied to piston rod

"...we wouldn't even consider analysing this way in a traditional mesh-based system – it would take too long to get any useful information out. We would have ended up splitting the assembly into multiple simplified parts and running separate simulations for each. This would easily consume a day, or would only allow us to check a small subset of the components in the assembly, and likely be less accurate."

Tony Jones
Engineering Manager, Andron Handling Limited

Figure 2 – Reaction at lifting eye

In conclusion, using SimSolid, Andron was able to quickly model the entire assembly in a very realistic manner with sliding connections, a clamping force on the pistons and matching reactions on the cylinder bodies. Total time from start to finish of the analysis (including all setup/preparation and fixing some errors in the CAD model) was only 1.5 hours.

"A final thought, we wouldn't even consider analysing this way in a traditional mesh-based system – it would take too long to get any useful information out. We would have ended up splitting the assembly into multiple simplified parts and running separate simulations for each. This would easily consume a day, or would only allow us to check a small subset of the components in the assembly, and likely be less accurate." says Tony Jones, Engineering Manager at Andron Handling Limited.

Figure 3 – Predicted displacement full system

About Andron Handling
Andron Handling Ltd. designs and delivers custom engineering handling solutions to the automotive and aerospace industry. Using innovative design and engineering,they help customers improve processes, reduce costs and increase employee productivity.
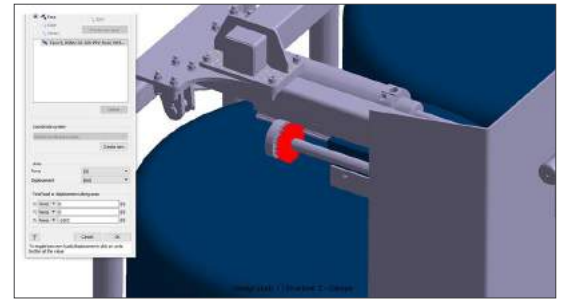

Figure 4 – Von Mises stress in clamping arms
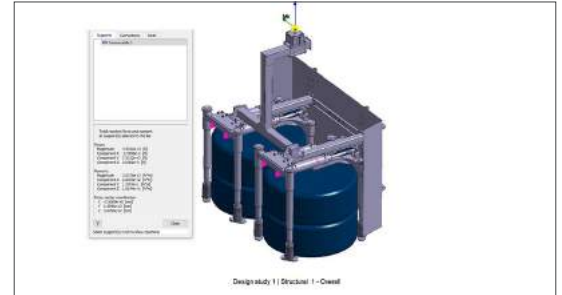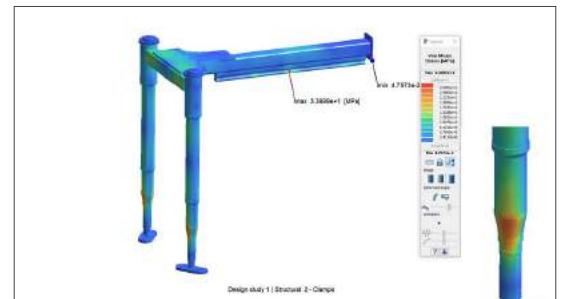
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