HEXAGON

Case study

Haver & Boecker Niagara

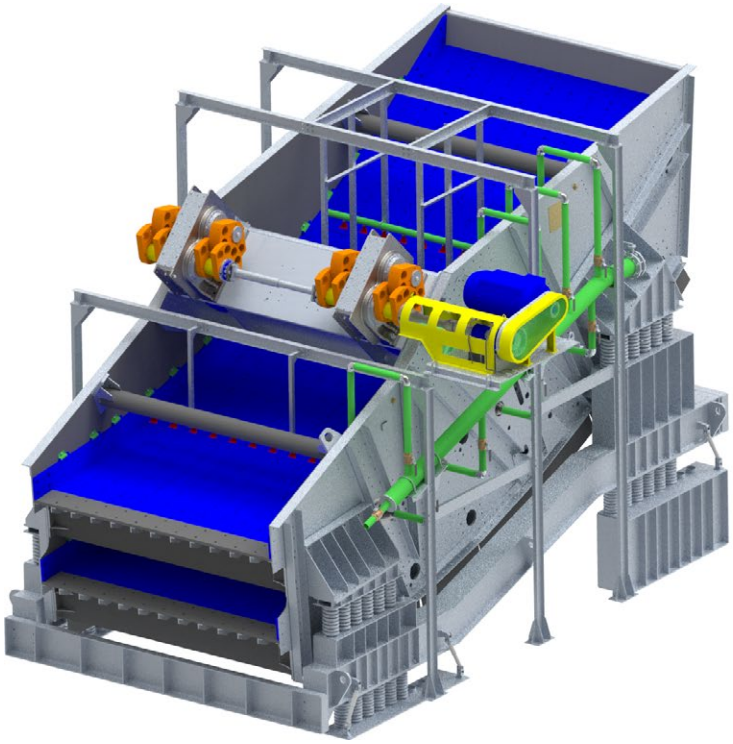
MSC Apex's Python scripting & customization reduces modeling and simulation time by 40%

"Before using MSC Apex, the process of midsurfacing and model creation could take 2 to 3 weeks starting from a 2D sketch. With Apex, we have the full finite element model in less than a week working straight from the 3D CAD, without having to create 2D sketches first. This was possible through scripting and customization that we could develop together with the MSC support team to match our specific needs."

Jansem Sasso Nogueira
Development Engineer, Haver & Boecker Niagara

If you're an engineer in the mining industry, you know that your equipment gets pretty beat-up. If it's not the actual rocks and dirt that are attempting to break your equipment, then it's the machine itself that's causing the damage, since it has so many large moving parts, violently shaking and vibrating 100% of the time.

Either way, the industrial mining equipment you're using has to survive this harsh environment – and it can't break down either, because as the saying goes, time is money – and every minute the machine is broken, money is lost. Because of this, lots of engineering goes into designing new industrial mining equipment so that it can stand up to this tough environment. Thankfully, MSC Apex was up to that task, and was able to speed up this important workflow by 40% compared to traditional workflows.



XL CLASS BMD 3660 x 8540 Datasheet		
Total mass	[kg]	61,000
Vibrating mass	[kg]	45,500
Amplitude	[mm]	4.00
Frequency	[RPM]	970
Acceleration	[g]	4.40
Internal width	[mm]	3,660
Internal length	[mm]	8,540

Figure 1: CAD model of the vibrating screen assembly

Challenges

Designing a new vibrating screen for the mining industry is an elaborate and complex task. These pieces of equipment are subjected to severe loads that ultimately will drive the machine acceleration up to 6g over the course of its lifetime. Additionally, due the size of its structure, vibrating screens have several natural frequencies that must be kept away from the operating frequency by a safe margin – requiring very careful design and analysis.

Because of the cyclical load that the driving system applies on the vibrating screen structure, it's crucial to find a right balance between the equipment's mass, stiffness, and stresses in order to prevent premature fatigue failure and provide the customer a reliable and cost competitive equipment. Since the vibrating screen is made of dozens of pieces held tight together by thousands of fasteners, it is not possible to perform the finite element analysis (FEA) for each component independently. The FE model of the entire mechanism has to be created and solved together, which is very time-consuming process, and can be frustrating to find and fix errors due to the size of the FE model.

The traditional process of designing a vibrating screen has proved to be reliable over the years, but it is not a fast workflow. Traditionally, Haver & Boecker Niagara engineers begin with a 2D sketch that was used to build a simplified geometry in a CAD software. This geometry was then exported to a preprocessing software where the mesh, connectors, loads, and boundary conditions were applied before solving the FE model using MSC Nastran. After a few simulations, the final design was taken back to a CAD software to build the final 3D model and start the detailed engineering process. This linear workflow makes the development time of a new design considerably long.

On top of that, the majority of time and effort was put into creating a simplified geometry and a high-quality mesh – tasks that Haver & Boecker Niagara engineers wanted to speed up using MSC Apex. Haver & Boecker Niagara development engineers aimed to reduce the whole cycle of product development using MSC Apex, while allowing more design iterations to be performed to achieve a better design.

During the evaluation of MSC Apex, another important requirement was to choose a software that could be fully integrated with previous simulation tools, so that Haver & Boecker Niagara could keep its 15-year finite element database without having to translate all of this legacy data into another format.

Solution

Haver & Boecker Niagara's development engineers benchmarked MSC Apex versus their previous preprocessing software and found out that it shortened the modeling time remarkably with defeaturing, geometry cleanup, midsurfacing, and direct modelling tools.

The second game-changing feature was the Python scripting and customization capability within MSC Apex. During the evaluation process, the MSC support team worked directly with the Haver & Boecker Niagara engineering team to develop customized python scripts to match their specific needs. Eventually, as the team became more familiar with these features, it led to them reframing their design process, allowing Haver & Boecker Niagara's engineers to work in almost-parallel paths with the 3D model and the FE model – thus saving significant amounts of time.

The new workflow has not just made the development time shorter as initially intended, but also provided more chances for their engineers to iterate on the design, optimize it, and provide a better product overall. The whole process was validated through both numerical simulation and experimental testing, where the data showed the same accuracy level Haver & Boecker Niagara is used to having.

Another key benefit from MSC Apex was its full compatibility with MSC Nastran which allowed Haver & Boecker Niagara's engineers to keep using and expanding its 15-year database of MSC Nastran solves, including fast, parallel solves for large dynamic problems.

> **"Our engineers are now looking forward to using MSC Apex to optimize more products of its portfolio."**
>
> **Jansem Nogueira & Paulo Totti,**
> Development Engineers, Haver & Boecker Niagara

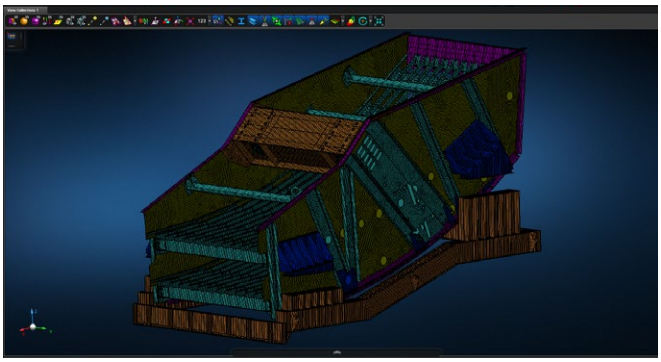


Figure 2: MSC Apex vibrating screen model

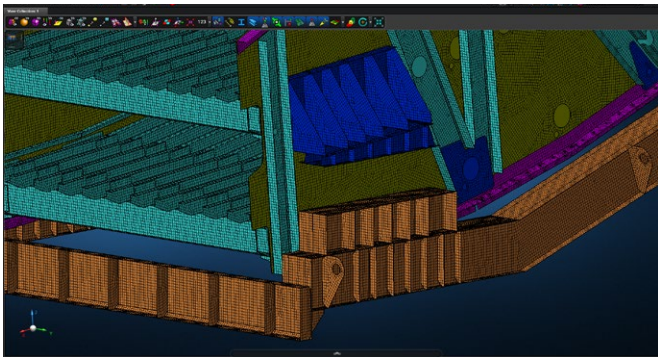


Figure 3: Close-up view of the vibrating screen MSC Apex model

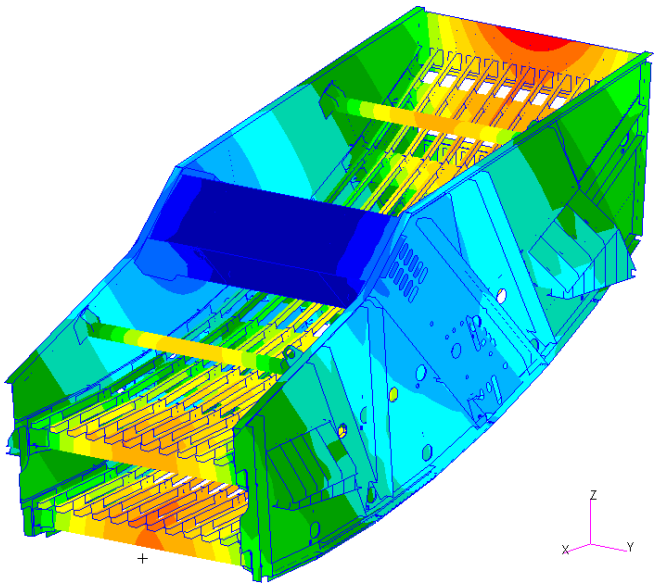
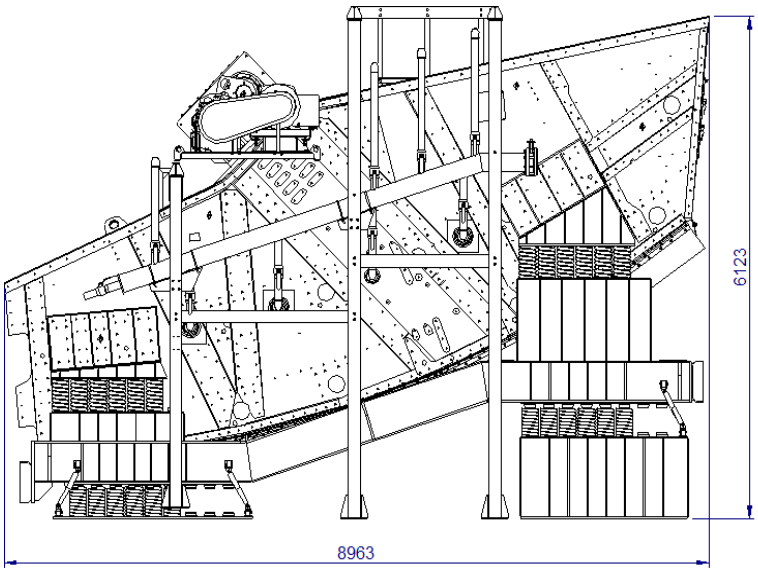
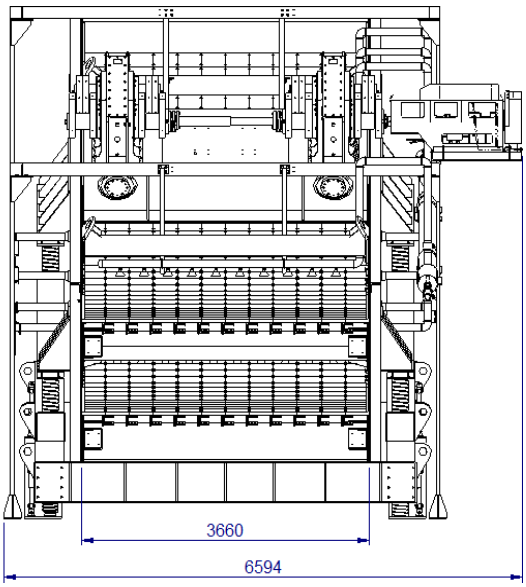


Figure 4: Dynamic acceleration results view of the vibrating screen model





Results

With the breakthrough features by MSC Apex, Haver & Boecker Niagara engineers were able to save 40% of the traditional development time of heavy-duty screen machines. A solver-ready mesh that used to take 2 to 3 weeks to develop now can be built in less than one week. This improvement is supported by a user friendly graphic interface, customized scripting, and efficient geometry & mesh editing.

Key highlights:

Product: MSC Apex

Industry: Mining

Benefits:

- Shortened the modeling time remarkably with defeaturing, geometry cleanup, midsurfacing, and direct modelling tools
- Python scripting further shortened the pre-processing time by automating repetitive tasks like mesh editing and connector creation
- MSC Apex's rapid analysis workflow allowed Haver & Boecker Niagara's design process to change from "design-then-analysis" to "design and analysis in parallel"
- Full compatibility with the MSC Nastran solver, allowing for 15-year legacy data support

About Haver & Boecker Niagara

Haver & Boecker Niagara is a leading provider in screening, pelletizing and primary crushing systems. The company's mission is to deliver the best of these technologies to customers in the mining, aggregates, minerals, cement, building materials, fertilizer and salt industries. With deep roots and years of experience in these industries, Haver & Boecker Niagara uses its innovative and shared technologies to effectively meet the needs of customers around the world.

Hexagon is a global leader in digital reality solutions, combining sensor, software and autonomous technologies. We are putting data to work to boost efficiency, productivity, quality and safety across industrial, manufacturing, infrastructure, public sector, and mobility applications.

Our technologies are shaping production and people-related ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

Hexagon's Manufacturing Intelligence division provides solutions that use data from design and engineering, production and metrology to make manufacturing smarter. For more information, visit hexagonmi.com.

Learn more about Hexagon (Nasdaq Stockholm: HEXA B) at hexagon.com and follow us @HexagonAB.