Stressman Engineering, Norway

Key Facts:

Company: Stressman Engineering

Website: www.stressman.no/

Description: Stressman Engineering is an engineering company focusing on mechanical stress analysis of pipes, vessels, structures, and other mechanical components.

Employees: 20+

Industry: O&G, Marine, Power, LNG, Onshore, Offshore, Fish Farming

Country: Norway, USA, Mexico

Products Used:

- CAESAR II®

Key Goals:

- Greater efficiency in pipe stress analysis
- Quick import of existing analysis provides time savings
- Solutions easily interfaced with other vendor software solutions increasing efficiency and ensuring the accuracy of analysis and models
- Clear visualization of where to focus analysis and backward engineering efforts

Stressman Engineering Resolves Dangerous High-Pressure Vibration Issues with Hexagon's CAESAR II

Identifying Goals

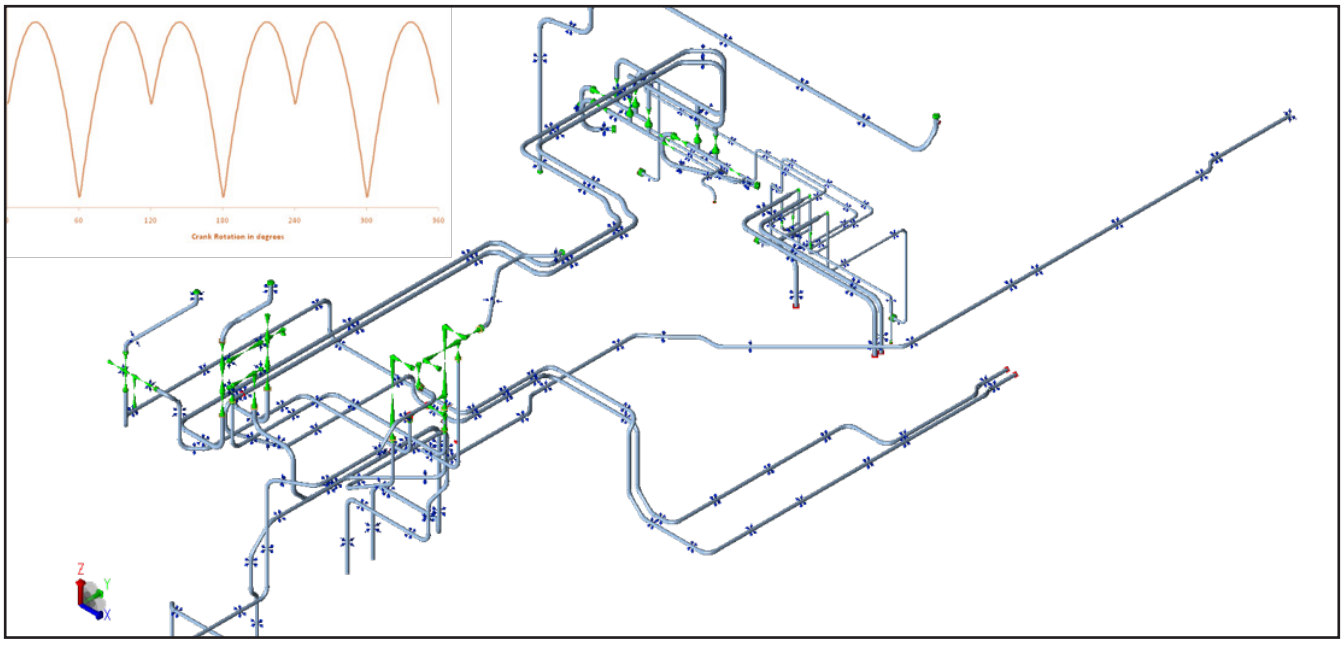
Stressman Engineering is a global Norwegian engineering company operating in numerical analysis since 2010, with a focused team that carries out mechanical stress analysis of pipes, vessels, structures, and other mechanical components. The company was selected by a client to discover where and why extensive vibrations were coming from an HP Mud system on a Norwegian oil rig, that was being manufactured in a shipyard in China.

Stressman Engineering needed a solution that would enable them to execute advanced analysis while adhering to industry standards to ensure safety, compliance, and fitness for service.

The goal of the multidiscipline project was to find the source of the vibrations and to carry out extensive pipe analysis to pinpoint the problem area. Resolving this would reduce stress and long-term damage to the client's piping system. This case study focuses on the initial problem of the excessive vibrations.

Overcoming Challenges

With the source of the pipe vibrations unknown in the HP Mud System, Stressman Engineering was selected to find the exact location and why they were occurring. The client's shipyard had previously carried out CAESAR II® analysis to find the source in the system, without success. This was due to extensive shaking by the heavy mud pumps, in addition to the system vibrating in different areas, making it hard to distinguish the exact problem. Using the shipyard's initial CAESAR II analysis and reports, Stressman could transfer the files into their own CAESAR II application seamlessly and begin modeling, comparing, updating and carrying out further analysis swiftly in that area.



An example of the HP Mud system in CAESAR II.

The engineers at Stressman Engineering had decades of extensive experience with Hexagon's CAESAR II solution.

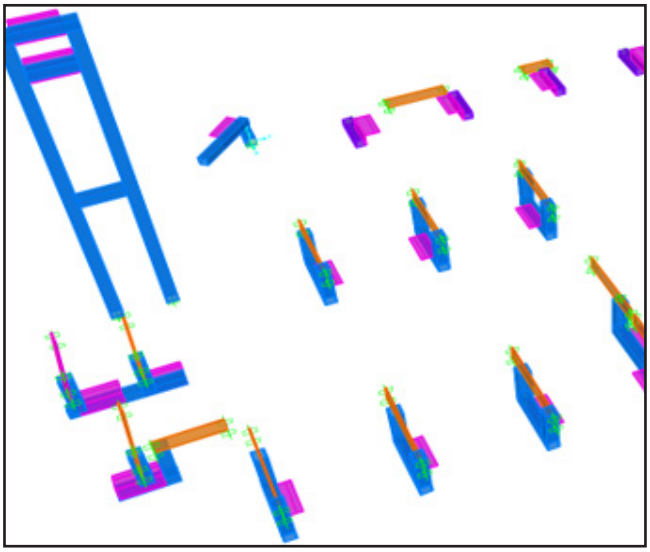
Realizing Results

The starting point of the project involved modeling the existing files again according to the system drawings via CAESAR II, to ensure an accurate analysis. From there, the CAESAR II piping files were exported for CFD evaluation. The BOSpulse application from DYNAFLOW, a third-party application, enabled further analysis working with CAESAR II to carry out the fluid pulsation investigation. The pulsation analysis data was then pulled from BOSpulse and imported quickly and accurately back into CAESAR II, to run the harmonic analysis. The harmonic analysis gave Stressman a clear visibility of how the piping system was responding to the pulsations.

Initially, the vibrations could not be seen in the analysis data where they were expected to be seen, when compared to the location of the vibration in real life. Therefore, it was decided that more in-depth analysis was required, taking into account all the pipe supports. This was done by modeling them in the SAP2000, powered by Computers and Structures INC, another third-party solution, which processed the stiffness of the pipe supports in the system. Once they were re-run, it resulted in the natural frequency of the system going down.

However, the pipe vibrations were still not amplifying as much as they were in real life. Backward engineering was then viewed as the best way forward to methodically work through the client's HP Mud system to find the source of the problem.

> **Integration between CAESAR II and third-party analysis solutions enabled us to carry out extensive analysis with accuracy and ease."**
>
> **Sondre Luca Helgesen**
> CEO Stressman Engineering



An example of pipe supports stiffness modeling in CAESAR II.

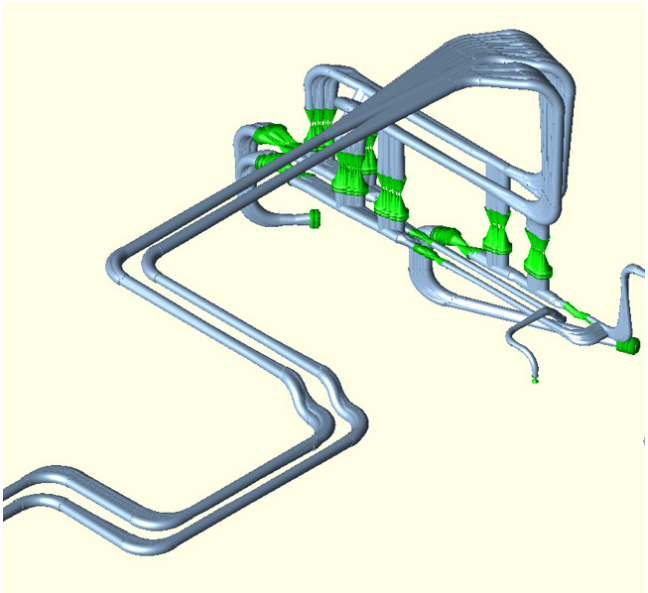
An example of pipe supports stiffness modeling in CAESAR II.

This would enable Stressman Engineering to see if, during installation, pipe support functions had been missed or incorrectly added to the structure, resulting in the vibrations exhibited.

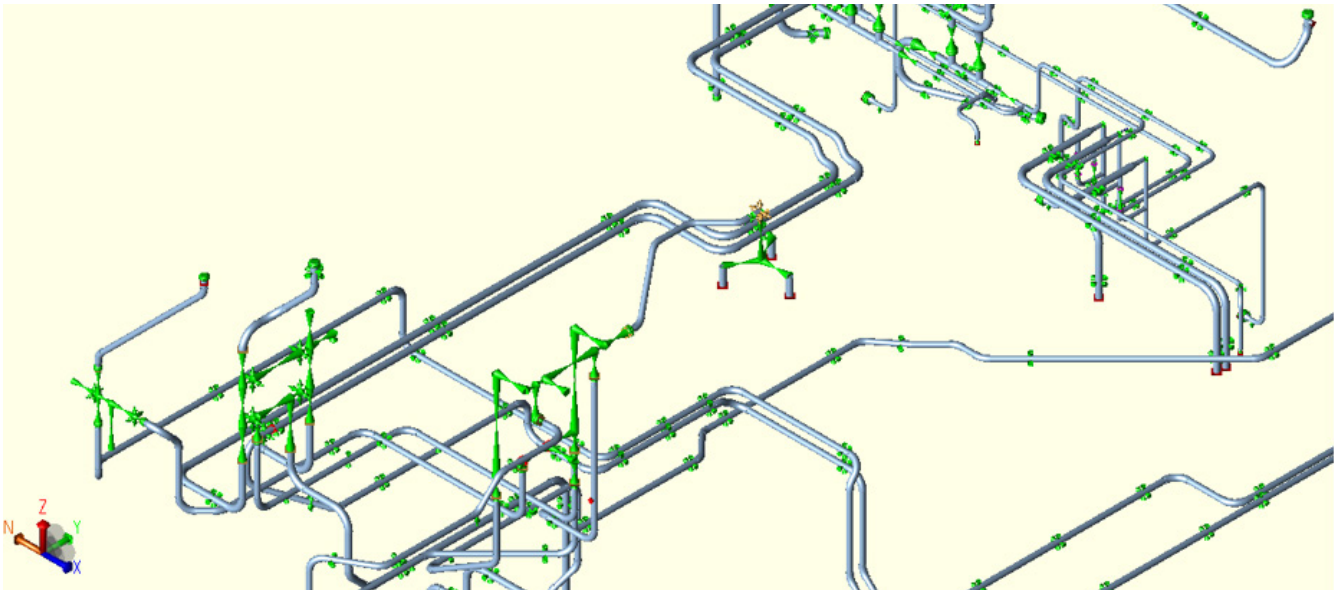
With a pinpointed area of where in the system the vibrations were coming from, it was then a clear process of working through the different supports and running and re-running of analysis. Throughout this part of the project, efficiency was maintained due to the ability to smoothly transfer data and files between CAESAR II and third-party applications, maintaining the accuracy of data and results. During the analysis carried out, Stressman Engineering identified a key pipe support in the system. The analysis showed that when the pipe support in question was removed from the CAESAR II analysis model, high-level of vibrations similar to the current response the HP Mud system was exhibiting occurred.

The next step was to discuss the drawings with the onsite implementation team. The drawings stated the pipe support was welded. Stressman Engineering believed that either the guide support had been missed in the assembly of the system, or it was acting as a rest support. The best way to find out if this was the case was for one of the team to physically climb to the top of the structure and photograph what could be seen. It could then be concluded from the photography that the pipe support had been installed but not welded to the support structure. This resulted in the pipe support acting as a rest support, sliding back and forth when the system was in use, causing extensive vibrations and not supporting the system, producing further vibrations. The support was then welded into place, and the vibrations stopped.

It took approximately three months for Stressman Engineering to find the source of vibration. The team began the project onsite in China before going back to Norway to run and complete pipe analysis and modeling remotely. The consequences of not being able to find where and why the vibrations were occurring could have resulted in a fatigue fracture and loss of structural integrity, which is critical. The HP Mud system is an integral part of the drilling process, controlling the well pressure. Failure of the main mud pipe can lead to accidents, rig downtime, and financial loss.



An example of the vibrations being produced in the HP Mud system when in CAESAR II.



An example of the HP Mud system in CAESAR II.

Moving Forward

Hexagon solutions were chosen because of their ease of use, accurate integration to third party analysis solutions, and due to being specified by the client. Stressman Engineering was able to carry out detailed modeling and analysis of the client's HP Mud system to find the area vibration and stop it. In the long term, this has saved Stressman Engineerings' client loss of structural integrity in the system, which could have led to rig downtime, compromised safety, and substantial financial losses.

The most significant benefit has been the optimization of work processes throughout the project due to easy integration with other third-party solutions, increasing accuracy and visibility. Time efficiency was also maintained because no manual calculating of data was required.

Stressman Engineering will continue using Hexagon's CAESAR II solution in its upcoming projects to ensure productivity and accuracy, with error-free analysis and modeling.

> **Backward engineering with CAESAR II allowed us to pinpoint and find the problem in this project, which was a safety-critical issue for our client."**
>
> **Sondre Luca Helgesen**
> CEO Stressman Engineering

HEXAGON

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Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous — ensuring a scalable, sustainable future.

Hexagon's PPM division empowers its clients to transform unstructured information into a smart digital asset to visualize, build and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire lifecycle.

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