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Shipbuilding • Oil and gas

GustoMSC

FEA for offshore drilling

Products

Femap, NX

Business challenges

Harsh ocean conditions

On-board drilling equipment

Long product lifecycles

Keys to success

Plate and beam modeling and meshing

FEA in the Windows environment

Customization via Femap API

Analyses run in batch mode on a server

Results

Engineers learn Femap easily

Hull analyses solved quickly

Automated routines determine loading conditions and interrogate results

Potential hull problems are found and eliminated during the design phase

Strong support for plate and beam modeling makes Femap an excellent solution for finite element analysis of mobile drilling vessels

Going offshore for energy

GustoMSC, part of the SBM Offshore N.V. group of companies, specializes in vessels used to locate and drill for offshore oil and gas. Offshore work beyond a depth of about 400 feet requires floating vessels because fixed structures are not practical. GustoMSC designs three different types of these vessels – jack-up rigs (floating barges with long support legs that can be raised and lowered), semi-submersibles (drilling platforms supported by pontoons located below the wave action at the surface) and drilling ships (ships equipped with drilling towers) – as well as associated deck-mounted equipment such as cranes. The company's services include design, engineering, procurement, project management and consulting. Manufacturing is done by a third-party shipyard.

Offshore drilling units present some unique engineering challenges. They are like other maritime vessels in that they are subject to the harsh environmental conditions of the open ocean. But they are different in that they also must support heavy drilling equipment.

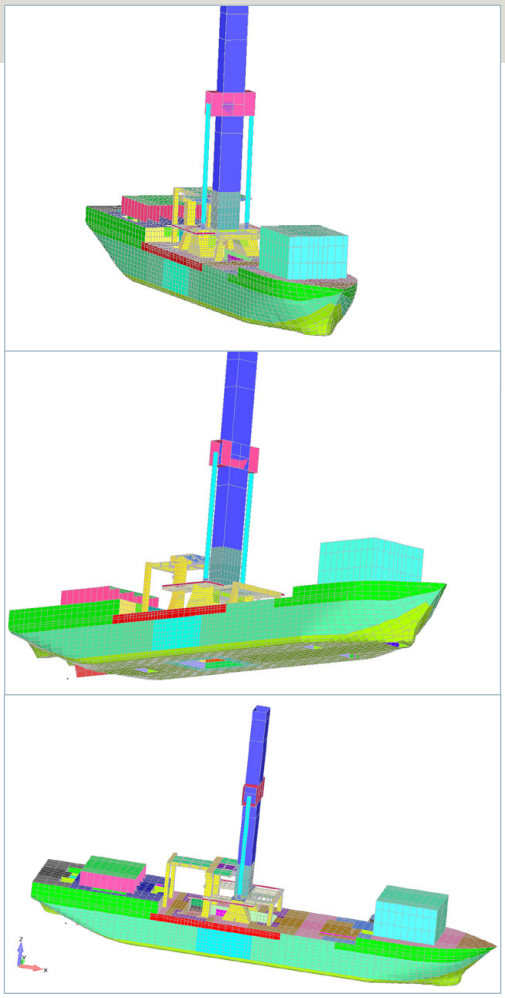
These conditions, along with the need to ensure decades of operation, make finite element analysis (FEA) an important tool for engineers in the naval architecture

department at GustoMSC. They use Femap™ software from Siemens PLM Software for FEA pre- and postprocessing, and NX™ Nastran® software, also from Siemens, as the solver. During busy times, the company can have as many as 30 engineers performing FEA. To free up individual computers, analyses are run in batch mode on a server using the VisQ™ solution, also from Siemens.

Part ship, part drilling rig

A drilling ship offers a good example of why Femap is an excellent pre- and post-processor for this type of work. The drilling equipment on the ship extends from the deck down through the hull, so there's a fairly large opening in the hull. "There are places where we know we need to pay extra attention in the design, and that opening is one of those places," says Timo de Beer, a principal structural engineer in the GustoMSC naval architecture department.

Using the modeling functionality within Femap, de Beer and his colleagues create a finite element model of an entire hull, with special emphasis on the area around the hole. This is done quickly and efficiently using plate and beam modeling, an area where Femap outperforms other preprocessors, according to de Beer. He adds, "Others focus on automatic meshing of complex mechanical components, which Femap can do. But if you tried to do that with something as big as a hull, your model would be composed of solid elements, which would be much too large. Modeling with beams and plates is a better approach, and something that Femap strongly supports."



"Modeling with beams and plates is a better approach, and something that Femap strongly supports."

Timo de Beer
Principal Structural Engineer
Naval Architecture Department
GustoMSC

Solutions/Services

Femap
www.siemens.com/plm/femap

NX Nastran
www.siemens.com/plm/nxnastran

Customer's primary business

GustoMSC is one of the leading design and engineering companies involved in all types of mobile units/vessels for the offshore industry.
www.gustomsc.com

Customer location

Schiedam
Netherlands

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Beam and plate modeling in Femap generates finite element models consisting of one-dimensional elements with associated properties such as beam cross sections and plate thicknesses. These models have far fewer nodes, so they run quickly. But that is not the only advantage. Femap includes visualization functionality that uses the cross section and thickness data to create a three-dimensional model for viewing purposes. Instead of a confusing display of lines, engineers see what de Beer refers to as "a nice view of the ship" that they can easily fine-tune to ensure an accurate analysis.

Customizing the solution

According to de Beer, there are several others reasons why Femap is such a strong pre- and postprocessing solution. One is its ease of use. "We like that Femap is accessible, that it's a standard Windows application," he says. "Our engineers can start work with it quite easily."

Another strength of Femap is that it has enabled GustoMSC to create customized FEA processes using the software's application programming interface (API). For example, applying loads to a finite element model of a hull can be complicated. "There are external loads such as the pressure from the water. That includes the continuous wave motion, which makes it especially interesting," de Beer explains. "There are also internal loads in the tanks. We created a program that automatically defines loads for us in a format that suits our needs." They also created a routine that interrogates the results for probable failure modes such as plate buckling. "API scripting has been a real time saver for us, eliminating much of the work of performing an analysis," de Beer adds.

Hull design is just one application for Femap at GustoMSC. The software is used across the product line for the design of the vessels themselves as well as for on-board equipment such as heavy-duty cranes. An easy-to-use program with extensive functionality, Femap is a good fit at GustoMSC.

Siemens PLM Software

Americas +1 314 264 8287
Europe +44 (0) 1276 413200
Asia-Pacific +852 2230 3308

www.siemens.com/plm

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