Seamless integration of NX and NX Nastran permits fast design-analysis iterations and reduces engineering time

Ships for many uses
Damen Shipyards Group is a global supplier of ships. Tugs, workboats, patrol craft, cargo vessels, dredgers, fast ferries, naval ships and mega yachts are all part of Damen’s product portfolio. Privately owned Damen introduced revolutionary new production concepts to the shipbuilding industry. By applying processes adopted from the automotive industry, Damen started using options and variants based on standardized ship designs. The repeatability introduced by Damen led to enhancements in the purchasing process, shorter delivery times and quality improvements.

Today, the Damen Shipyards Group consists of more than 30 shipyards in all parts of the world, including Poland, Romania, China, Dubai, Singapore, Cuba and South Africa. The annual production of the Damen Shipyards Group amounts to some 150 vessels. “The basis of Damen’s success is the global sales network,” explains Marcel Karsjins, manager of the Equipment, Project and Systems Engineering (ESPE) department. “In close contact with customers, the sales force and the proposal engineers translate customer requests to product definitions and roadmaps. Standardization is the basis of
product development and standardized ships account for 80 percent of the order intake. The remaining 20 percent are one-offs.” The ESPE department provides a wide range of services including engineering support.

Integrating the analysis process
Due to strict regulations in the shipbuilding industry, digital simulation plays an important role within the Damen Shipyards Group. Product designs as a rule are analyzed using the Femap™ finite element analysis (FEA) pre- and postprocessor and the NX™ Nastran® FEA solver, both from Siemens PLM Software. “A large part of the basic engineering of a vessel is done in AutoCAD and Nupas Cadmatic,” says Don Hoogendoorn, project engineer in the research department. “Subsequently, our department validates these designs using digital simulation with Femap and NX Nastran.”

Due to the increased workload of the research department, Damen needed a way to reduce data translation effort and improve the efficiency of the product development process. “So we decided to invest in an integrated, state-of-the-art 3D design and simulation environment,” notes Jerry Baffa, project engineer in the research department.

The company first evaluated mid-range CAD applications. But tests showed that the simulation environments did not meet the expectations of the engineers. The import facilities also weren’t satisfactory. The same was true for the functionality for modifying imported data. “We did some testing but the overall results were rather disappointing,” says Baffa. “Both the CAD and the CAE functionality did not meet our requirements. We needed robust design functionality for complex shapes and large assemblies as well as the functionality to modify imported geometry. The more simple geometry was already being handled by Nupas Cadmatic, which is the standard within Damen Shipyards Group.

“We decided to acquire NX and NX Nastran, which was the only integrated CAD/CAE environment to satisfy our demands,” Baffa continues. “Both applications provide ample functionality to tackle even the most demanding engineering tasks.”

User-friendly and accurate
Even though many engineers were familiar with mid-range applications, they were quickly convinced by NX capabilities and user-friendly interface. “There are many obvious advantages to 3D,” says Karsijns. “It provides unparalleled insight into the design, eliminates the translation from the mental 3D image to the 2D drawing, provides a dramatic reduction in the number of errors on drawings, and last but certainly not least, its commercial value is enormous.”
The implementation of NX alongside Nupas Cadmatic is expected to further increase these advantages. “Since we plan to use NX for the more complex designs, its advantages over the traditional 2D process are even more pronounced,” says Hoogendoorn. “During the NX pilot phase we redesigned a complex rigid coupling between barges manufactured from cast steel. The reason for this was that a physical test showed that the coupling was a lot stronger than initially calculated. The design itself was good; however we were unable to pinpoint the cause for this. Together with experts from Siemens PLM Software we set up the model in NX and redefined the load case taking all influences into account.” The new physical test showed the same results as predicted by the digital simulation using NX and NX Nastran. For Damen, the test proved the accuracy of NX digital simulation for such complex endeavors and demonstrated the added benefit of being able to pinpoint the reasons for the strongest designs.

NX and NX Nastran will be implemented in both the research and engineering departments. “An additional advantage of NX and NX Nastran is scalability,” says Hoogendoorn. “We are able to provide tailor-made functionality to the users. As the engineering department takes over the more regular CAE tasks, they will use NX design simulation together with NX Nastran. We will support these tasks with protocols for design simulation.” Examples are stress and strain analyses of supports for on-board equipment, such as cranes, where load cases and calculation protocols are well defined.

**Synchronous technology advantages**

The integration of NX and NX Nastran allows for fast design-analysis iterations. The protocols will ensure that the engineers adhere to the approved working method. The research department will still check the quality of the work done, but will have more time available for more complex CAE tasks and research. “For our own work, we use NX with NX Advanced Simulation,” says Baffa. “The Advanced Simulation bundle allows for flexible handling of the meshes and all the CAE functionality we need, such as frequency analysis, buckling and friction.”

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Don Hoogendoorn
Project Engineer
Research Department
Damen Shipyards Group

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An additional advantage of NX is that it handles the Nupas geometry. "NX synchronous technology provides excellent functionality for making changes to imported CAD geometry," Baffa adds. "Nupas geometry can just as easily be meshed as native NX geometry. When analysis results demand design changes, we can apply these efficiently using synchronous technology. Remeshing is effortless and results in very short design cycles. Using NX with NX Nastran for the construction of the coupling has already saved Damen several months of work compared to the use of AutoCAD where designs had to be remodeled. The results of the pilot project hold the promise of huge savings in engineering hours and reduction of throughput time."

The rollout of NX and NX Nastran will take place as a planned evolution. The more than 200 engineers still do most of their work in AutoCAD. "It will take time to migrate the product portfolio to NX and Nupas," explains Hoogendoorn. "The research department must define working methods in compliance with the quality demands set by regulatory bodies like Lloyds. We also have to define how to integrate the NX CAD and CAE data into our current data management environment. When this preparatory work is done, we will be ready to reap the benefits our initial trials promised."

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