Program advances enable faster design and integration

Advances in computer power have enabled software companies to redevelop ship design programs, releasing upgraded versions or completely new packages.

Ship design software companies have released new programs with advanced CAD and computational fluid dynamics (CFD) features. Software upgrades incorporate improved meshing and database applications, more integration and interfaces, providing better reports and post design analysis.

New programs offer rapid processing and greater flexibility for designers, at a time when shipyards are striving to reduce design and engineering time. Greater software sophistication enables 3D modelling and CFD calculations to be implemented at an earlier stage. Increasingly, programmers are offering full project lifecycle solutions as shipyards are driven to manage construction costs and expand their own services.

A group of Dutch companies have jointly created a pre-contractual design platform that can be incorporated in ship design and simulation programs. The Innovero project is a collaboration between shipyards, software houses, test facilities and universities, jointly developing conceptual design software.

The program will help designers enhance their understanding of the characteristics and capabilities of concepts by hosting a method to refine vessel designs. The project collaborators include shipbuilder Damen, technical companies Imtech and Marin, ship designers Conoship and SARC plus Delft’s technical university.

In an early conceptual design stage, the ship designers’ ability to concurrently apply design and simulation tools from different disciplines is limited. The designers’ work is not helped by the fact that many of the more advanced tools require a geometric representation of the design concept as an input.

Part of the Innovero project involved creating meaningful geometric representations of internal ship structures, such as compartments, bridges, enginerooms and cargo holds, in the pre-contractual design phase. Innovero has advanced this process by introducing a method for a designer to mix the use of volumetric entities and spaces defined by 2D planes such as bulkheads and decks, said SARC director Herbert Koelman.

The modelling method can be applied as a tool to manage ship subdivision constraints. These would include bulkhead locations, required tank volumes and deck areas. The project partners devised a constraint management tool to evaluate the ship layout during the design process. “The designer will be able to modify or add constraints and the tool will support the designer by managing these constraints during the design process,” said Mr Koelman at the Computer and IT Applications in the Maritime Industries conference in Berlin in May.

“If the hull form changes, all submitted rules will be updated according to the new main particulars. If one of the constraints does not comply, an adjustment or alternative can be chosen at that moment and the impact of this change is directly visible. The designer can also ask the tool to provide a ship layout design that best complies with the constraints entered.

“A feasible ship compartment design can then be generated. This means that a correct ship layout model is available on which probabilistic damage stability calculations and weight estimations can be performed at an early stage.”

The next step in the project is to combine the constraint management method with the option of being able to vary the direction and design parameters of the hull form. “This way, the effect these changes will have on layout, areas, volumes and capacities, as well as on additional performance characteristics of the design like resistance, weight and costs, can be investigated and included in the process of finding an optimal solution,” Mr Koelman added.

SARC is in the middle of redeveloping its Fairway design software for the next generation of CAD requirements. It had to change the computer language of the main components from an old version of Pascal to C++ in order to communicate with support libraries such as Nokia’s Qt framework for the user interface and Coin3D for hardware accelerated graphics, said SARC’s design software specialist Bastiaan Veelo. Both Qt and Coin3D support multiple computer platforms including MS Windows, MAC and Linux, which means these will be used in the future. “Our biggest wish is to extend Fairway with new exciting features like spatial deformation,” Mr Veelo said.

Fairway is used for hull form design – starting with a basic shape or a previously defined form, the manipulation of multiple solids for hull and superstructures and the export of hull data for finite element and CFD applications. The software offers direct control over hull co-ordinates and line geometries. The hull surface is shaped through lines superimposed on the surface. Changes in line geometry are automatically included in connected lines and new lines can be generated.

Alabama-based Intergraph has developed a new version of CADWorx and gained contracts...
to supply its SmartMarine programs as shipyards strive to reduce design and engineering time. For plant design, CADWorx is now compatible with Autodesk’s AutoCAD 2012. It has an improved pipe support module and integrates 3D plant modelling with model walkthroughs. There is a new centre of gravity calculator, and stiffening rings can now be added internally and oriented about their primary axis. Intergraph offers the SmartMarine and SmartPlant Enterprise integrated solutions for the full design, construction and maintenance of large marine and offshore projects. The company recently gained a contract to supply the SmartMarine Enterprise and SmartPlant suite of programs to STX France.

The shipyard expects the software will reduce design man-hours and improve quality throughout the project lifecycle. STX France chief information officer Christophe Dutrieux said: “SmartMarine Enterprise has a large scale of integrated functionalities that are required to design complex works such as cruise ships. It enables us to co-ordinate activities of hundreds of designers and sub-contractors by sharing the same model, the same catalogues and – by building a single bill of material of the ship – to improve integration and co-ordination between design and construction.”

STX France considers the management of bills of material as a key element of the SmartMarine program as it is an interface between engineering and business systems such as SAP. The company will use Intergraph’s software to build its next cruise ship prototype in 2013.

In another deal, PetroVietnam Marine Shipyard in Vietnam has chosen SmartMarine 3D as its preferred engineering and design software for its offshore and marine projects. Implementation of the programs has led to increased accuracy of design and productivity, as well as acceleration of the shipyards’ projects. SmartMarine 3D and the SmartMarine Enterprise solutions will enable the yard to take on more projects. The yard will integrate design, construction, production and planning of offshore facilities with the software.

Numeca International has released its latest version of Fine/Marine software with CFD and expanded Hexpress meshing capabilities. The 2.3-1 version speeds up the mesh generation process, adding more control to layer insertion and increasing the number of user-friendly functionalities.

CFD upgrades include improvements in the adaptive grid refinement technique and streamlines around vessel hulls.

CD-Adapco’s software uses CFD to model streamlines around vessel hulls

Social computing will integrate building and design

Ship designers will increasingly use social networking for sharing concepts and workloads. The globalisation of shipbuilding means designers will gather and distribute more information across social groupings, through project teams, communities, and around different organisations.

This means designers will find more open source programs and applications, said David Thomson, a consultant with Aveva Group. “Social computing has resulted in a new approach to technology and many innovative features that are highly applicable to enterprise IT systems and information management. In shipbuilding this leads to globalisation of workflow, where many people can work together on ship design CAD drawings. A European shipowner, an Indian designer and a Chinese shipyard can use the same tools to solve engineering problems together.”

Social networking could be used in product lifecycle management where a product is designed and maintained through an enterprise IT system comprising of CAD, repair and maintenance management, and enterprise resource planning.

All this produces huge volumes of data that need to be maintained and stored effectively.

“Social computing has taught us that capturing and storing huge amounts of unprocessed data has value. Personal knowledge networking has emerged where the shift is away from formalised top-down knowledge management, towards informal management. Instead of accessing a centralised server, users utilise a combination of social computing tools to find out what they want.”

Aveva is developing a portal to enable further managed use of social computing for designers and shipbuilders. It will help integrate data from planning, design, engineering, procurement and manufacturing processes for rapid deployment of information. The common digital information hub is powered by Aveva Net database technology.

“The concept of Aveva Net is to capture automatically the human interaction with all activities in an integrated shipbuilding system, such as designing, production, catalogues, component lists, design assembly and documentation,” said Mr Thomson. “It would enable the natural social behaviour required to effectively propagate, consume and analyse this data. It can help store sessions of design in a database that can be fed into purchase documents, keeping people updated with feeds on project progress.”

The core concept is that there is one page per object that displays information relevant to the product, including technical attributes, drawings, diagrams of cabling, or pipework and a 3D view. “Each part of a project will have a unique portal page and will have its own feed. There would be a home page for a pump or a hull panel, a home page for the user to keep track of objects they are working on and home pages for planned events, such as vessel float-outs, or to book gantry cranes or drydocks,” Mr Thomson said.

Any changes to the element would be documented on the home page and alerts sent out to those involved. Aveva Net would automatically integrate changes to events with office calendars and could allocate resources for tasks. It would aid CAD of ship systems and equipment procurement.