# MSC Apex and Hexagon PPM
## Smart 3D Integration

### A Complete Engineering Solution for the Shipbuilding Industry

By **Bhoomi Gadhia, Product Marketing Manager, MSC Software**

From recreational craft, to tankers, to ships built for defense and homeland security, modern shipbuilders are creating enormously complex systems. Driven by market pressures to control production, reduce operating costs, address environmental concerns, ensure safety, and increase human comfort, manufacturers look to reduce material costs, design, and development costs.

Shipbuilding industries are required to maintain their 3D "as-built" representations. Most of these massive assemblies require many manual parts, welded together. Because of the complex representation, they share some of the same design engineering characteristics.

Hexagon PPM's Intergraph Smart 3D provides all of the capabilities needed to design ship structures and maintain their 3D "as-built" representations.

Engineers typically try to predict stress distribution throughout the structure and the final assembly capacity to carry loads. The structure's performance is then typically optimized through design iterations. Engineers will then either affect the shape or position of load bearing members to change the overall load path through the structures. Until recent years, engineers in the shipbuilding industries have not typically used finite element analysis but relied on hand-calculations and assumptions.

Parts & Assemblies

Plate Parts

Stiffener Parts

Virtual prototyping solutions, such as MSC Apex, ensure safety and reliability and helps make the design and verification process faster and more efficient. This not only saves considerable cost, but also allows users to gain deeper understanding of the product behavior and improve the designs well before production.

MSC Apex automates many time-consuming tasks such as creating mid-surfaces, applying appropriate thicknesses, as well as properties to mid-surfaced geometries. MSC Apex also makes it easy to connect parts together, whether they are mesh-dependent or mesh-independent, using the edge tie or glue contact capability. The automation of the defeature operation for any standard or user defined features is also a one-click process with MSC Apex's scripting technology.

By integrating Hexagon PPM Smart 3D with MSC Apex, a complete engineering solution is provided. MSC Apex Scripting Technology translates the Smart 3D CAD data of the ship model into CAE specific geometry model that will be consumed within MSC Apex to build a simulation model.
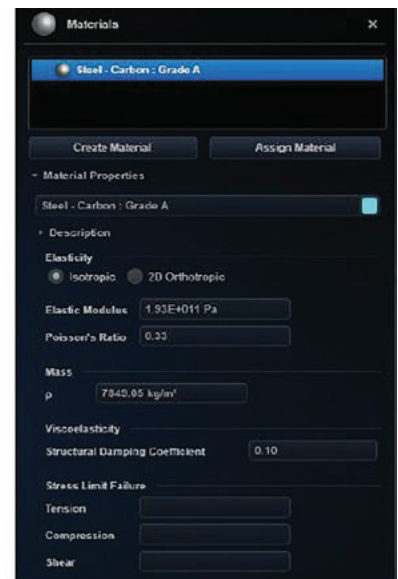
Hexagon PPM Smart 3D exports the CAD model in Neutral XML format. This XML file contains the midsurface geometry of 3D solid parts as surfaces represented as parasolid surfaces in MSC Apex, stiffeners, and beam-like structures represented with curves that are rendered with 1D beam spans into MSC Apex.
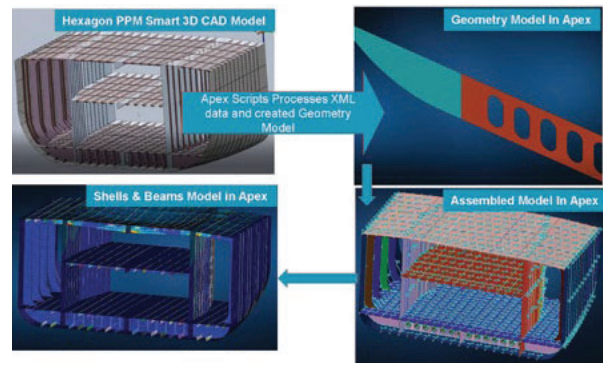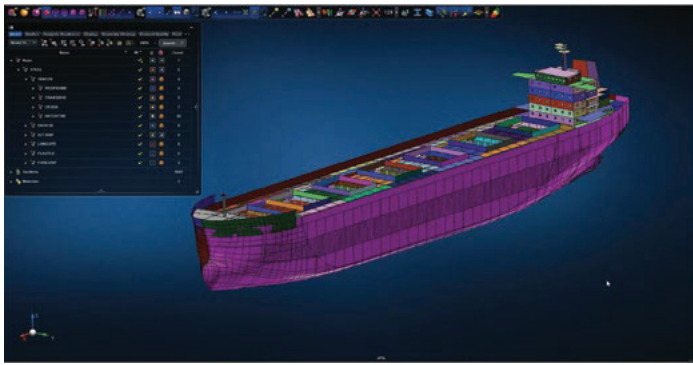
Along with the parts and assemblies, materials and other properties, beam definitions are also brought into MSC Apex using scripting.

Below is a process chart showing a ship section demonstration of the Smart 3D integration with MSC Apex. Hexagon PPM Smart 3D CAD model XML data is processed by MSC Apex scripts and a geometry model is created. This geometry model is imported into MSC Apex with material properties and beam definitions extracted from an XML file. This model is then connected using mesh-dependent or mesh-independent connections within MSC Apex and different finite element analyses are performed on these structures.

This integration between Hexagon PPM Smart 3D with MSC Apex scripting technology, provides a next level engineering solution. MSC Apex Scripting Technology automates the translation of the Smart3D CAD data of the ship model into a CAE specific geometry model. This can then be used within MSC Apex to build a simulation model. Smart 3D and MSC Apex allows interoperability of different 3D models that can be streamlined with CAD and CAE without having to go through a full project conversion.