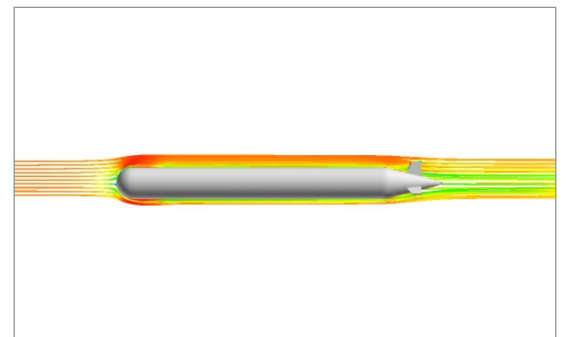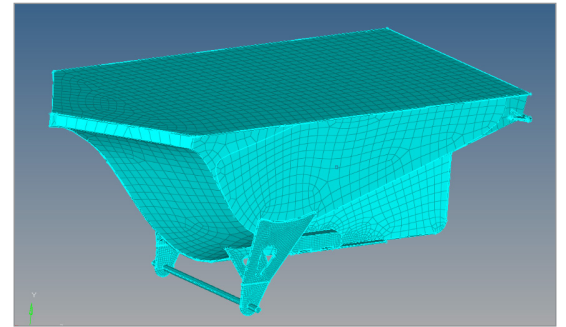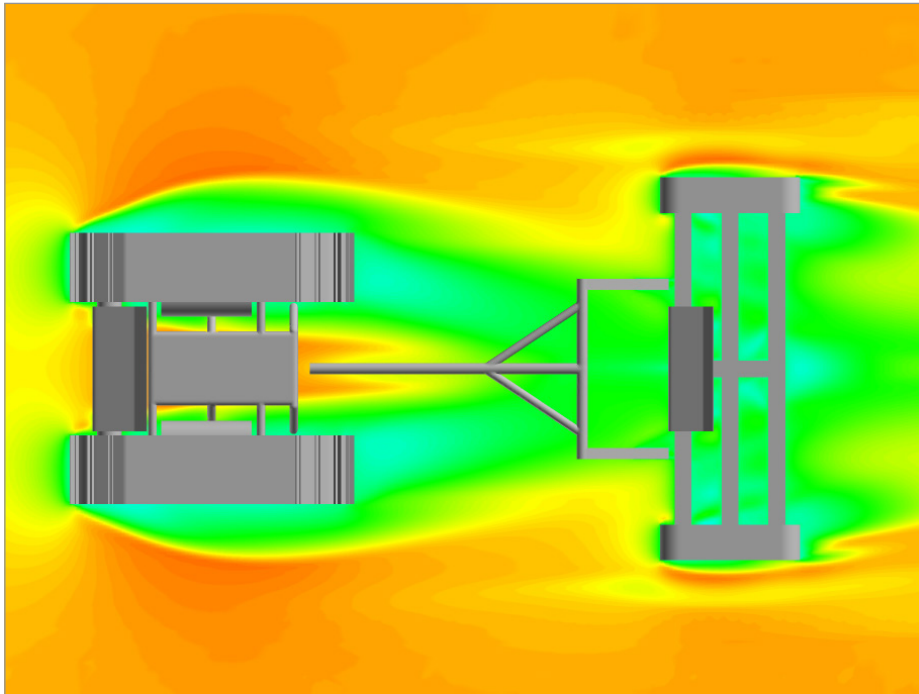DSA

DSA uses HyperWorks to Streamline its Marine Hydrodynamics Analyses with ProteusDS and ShipMo3D

Overview

DSA is an ocean engineering consultancy and software company. DSA provides solutions that enable marine service providers, project developers, ocean engineers, naval architects, oceanographers – or anybody with business in the water – to assess the effect of currents, winds, and waves on their vessels, technologies, and projects.

DSA produces two advanced hydrodynamic marine analysis software packages ProteusDS and ShipMo3D. DSA also provides a range of ocean engineering consulting services to marine businesses, often using ProteusDS and ShipMo3D.

ProteusDS is a marine dynamic analysis software package. It enables analysis of flexible structures such as mooring lines and pipelines, and hydrodynamic analysis of vessels and floating or fixed offshore structures. ShipMo3D is a panel-based boundary-element method (BEM) solver that resolves wave loads on ship structures at forward speed. It is a seakeeping, and maneuvering analysis tool. ProteusDS and ShipMo3D are available via the Altair Partner Alliance.

Challenge

Creating high-quality meshes is a difficult task in CAD software. The mesh is often not well conditioned for hydrodynamic solutions which require a closed surface for resolving hydrodynamic effects (e.g. nonlinear hydrostatics, BEM solution).

Solution

To build an accurate ship hydrodynamic model, ShipMo3D requires the development of a mesh of the vessel hull. Achieving this in ShipMo3D can happen in one of two ways: 1) Through the creation of hull lines and 2) Through importing an OBJ mesh file which has been created using 3rd party software. DSA uses Altair HyperMesh to create these mesh files from CAD files in a fraction of the time it takes to enter hull line data. Altair HyperMesh allows DSA to adjust the mesh effectively and ensures the most efficient and accurate mesh is used.

Industry
Marine & Offshore

Challenge
Creating a high-quality hydrodynamic mesh and model for ship and marine structures

Altair Solution
Using Altair HyperMesh™, Altair AcuSolve™, and Altair Virtual Wind Tunnel™ with ProteusDS and ShipMo3D from DSA

Benefits
• Less re-work
• Faster simulation times
• Increased profits

Once the mesh is imported into ShipMo3D, ShipMo3D uses a boundary element method, based on a paneled surface, to determine the hydrodynamic response of a ship to waves and motions. This allows a user to determine things like vessel pitch and roll response, vertical and lateral accelerations, and overall maneuvering and seakeeping characteristics. Leveraging the Altair HyperMesh generated hull mesh, ShipMo3D can create accurate load and motion RAOs (response amplitude operators).
RAOs tell us the response or loads that a vessel will experience in different wave conditions and different forward speeds.

Similar to ShipMo3D, ProteusDS uses hydrodynamic meshes for calculation of hydrodynamic loads. In the example to the right, a NOMAD buoy, used in the offshore wind industry for LIDAR measurements, is meshed in Altair HyperMesh. The mesh that is created will be exported for use in ProteusDS. One of the key strengths of ProteusDS is the calculation of mooring system response. ProteusDS can take the mooring system for a NOMAD buoy, and determine the anchor and fairlead loads – as well as the maximum internal mooring line tensions. This technology allows users to determine the optimal sizes and lengths of wire rope, chain, or synthetic rope to use to moor the buoy.

ProteusDS will generate an automated report of all the loads, and buoy motions. This data can be used to ensure that accurate measurements can be made, and therefore greatly reduce buoy operator's risks. For example, the figure to the right shows streamlines that have been generated by Altair AcuSolve. A database of coefficients can be generated from this which can then be fed into DSA's ProteusDS software, to enable simulations of the subsea vehicle with a comprehensive marine environment (e.g. waves, wind, current, and bathymetry). DSA has also begun using Altair AcuSolve and Altair Virtual Wind Tunnel on a routine basis as part of its consulting work. They are forming integrations in their software that will allow results of AcuSolve and VWT to be readily exported. The database functionality in ProteusDS is well structured to handle both fully and partially submerged structures. For example, a ship or a remotely operated vehicle could also use this workflow.

"Our team struggled for years to develop high-quality hydrodynamic meshes using CAD software and free tools. We always compromised and had to do costly project re-work when meshes failed to provide expected results. HyperMesh has helped us to reduce these issues."

Dean Steinke,
CEO, DSA

Conclusions
The benefits of using Altair HyperMesh™ with DSA's software and on consulting projects:

- Saves re-work due to numerical meshing errors often present in mesh exports from other software
- Faster simulation run times in ProteusDS due to optimized meshes
- Saves engineering hours, making consulting projects more profitable

The value that Altair AcuSolve brings to dynamic analysis with ProteusDS, is hard to overstate. Empirical "text book" data can be useful, but so often more accurate drag coefficients are required for a detailed analysis of a structure. In addition, ProteusDS makes AcuSolve data come to life – by allowing users to complete accurate time-domain dynamic simulations of rigid bodies without the computational and person-hour expense required to run transient CFD simulations.
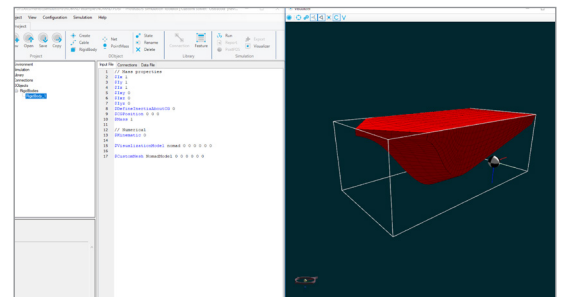
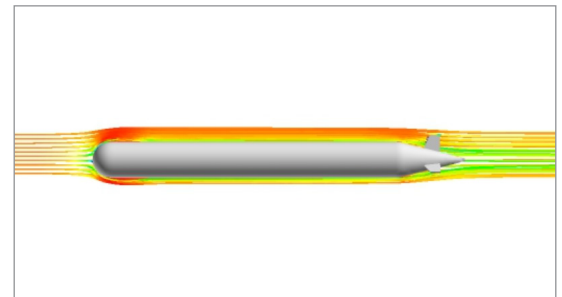Both ProteusDS and ShipMo3D are available to Altair HyperWorks customers via the Altair Partner Alliance.
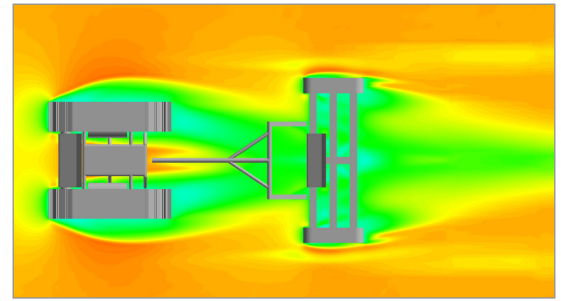
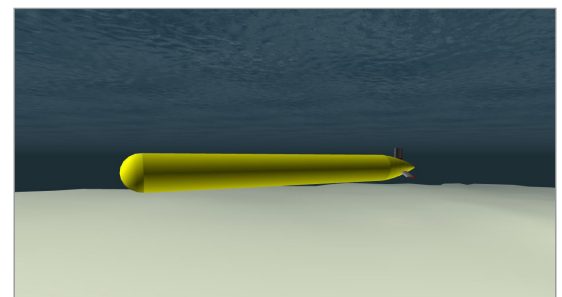*Submerged sled assembly in forward flow in Altair Virtual Wind Tunnel*
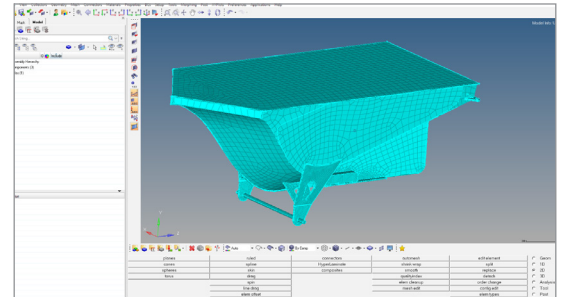
Bouy mesh imported into Altair HyperMesh

Mesh is refined and imported into ProteusDS to use with a rigid body 6 DOF motion simulation

Streamlines generated by Altair AcuSolve

Altair AcuSolve results imported into ProteusDS for marine environment simulation

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