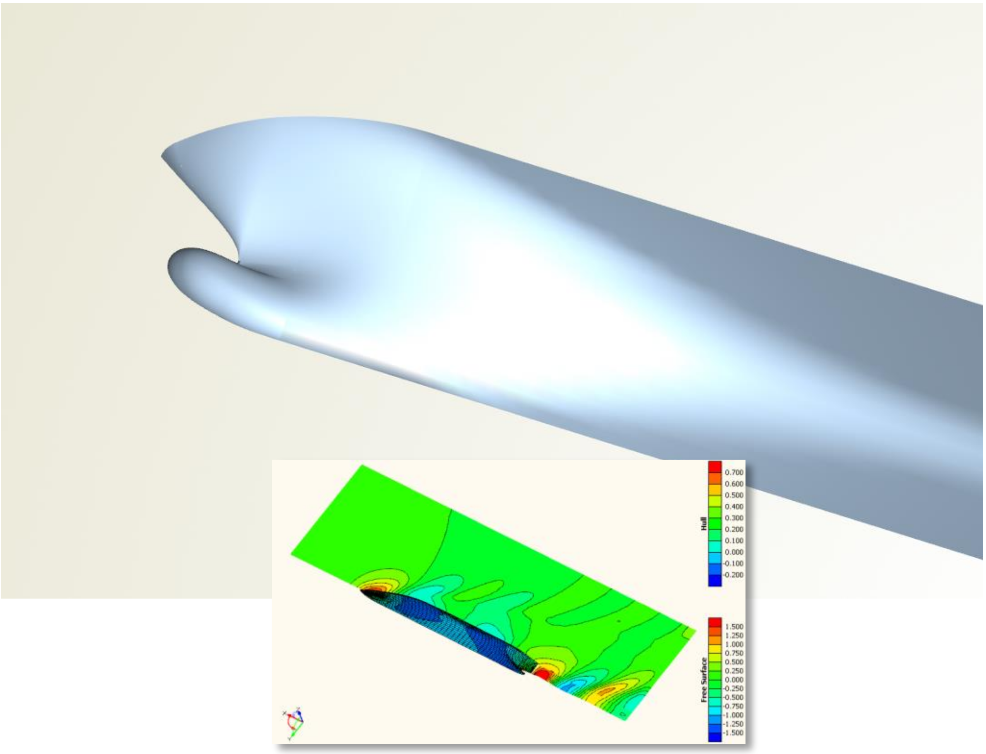
Tutorial

SHIPFLOW CFD Analysis

This introductory tutorial shows how to run the CFD-package *SHIPFLOW* from within CAESES. In order to keep it simple, an existing IGES geometry is utilized. The CFD settings are configured and a computation gets run finally. The calculation results can be accessed and post-processed, for instance, wave patterns can be visualized in the 3D view.

CAESES Project

The resulting setup can also be found in the section *samples > tutorials* of the documentation browser.



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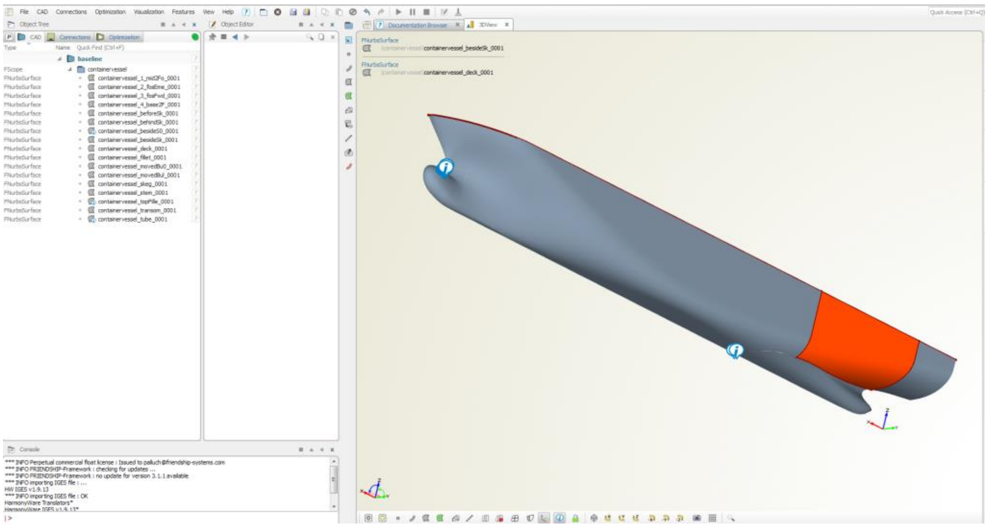
Initial Geometry

The hull needs to be imported first. Instead of using an existing IGES geometry, the subsequent steps do also apply for any parametric model that has been created in CAESES.

- Choose *file* > *import* > *IGES*.
- In the installation path of CAESES, open the geometry file *tutorials* > *06_hull_design* > *containervessel.iges.*

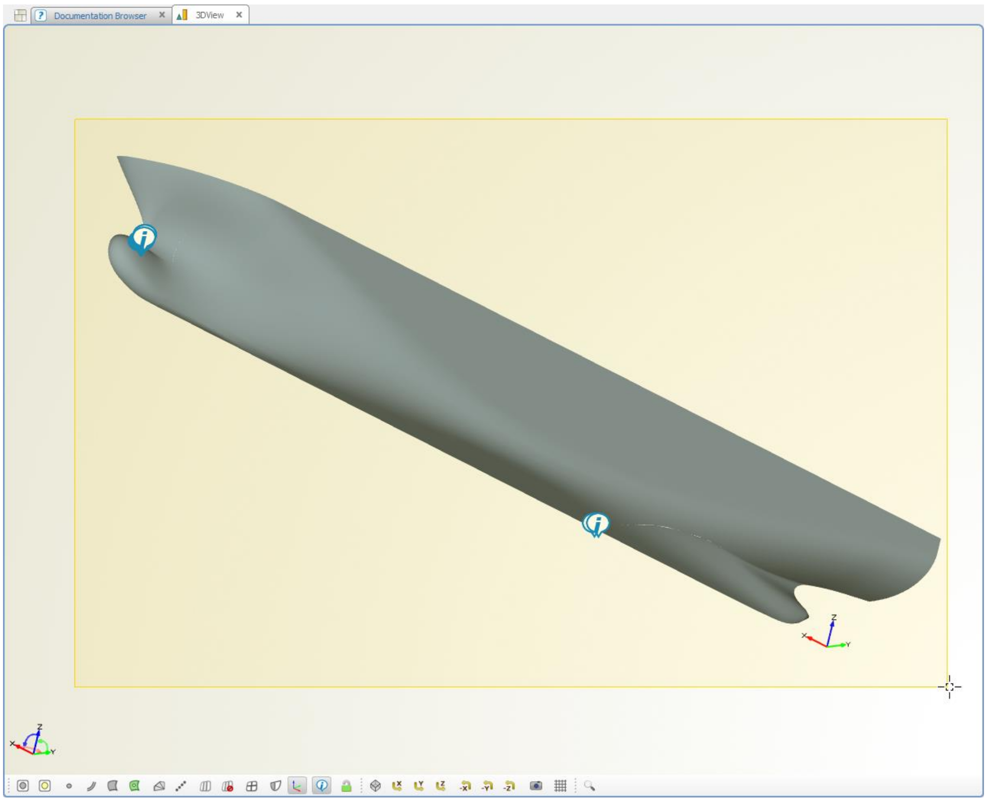


✓ The white-blue-colored icon with the exclamation mark in the 3D view indicates potential problems of triangle tessellations such as overlapping triangles. This is of interest when coping with STL data, for instance. This visual warning can be switched off by a corresponding button with the same icon at the lower toolbar of the 3D view.

Surface Group

We need to assemble all surfaces in a *surface group* to have a single object for the upcoming *SHIPFLOW* configuration.

- Select all surfaces either in the 3D view or in the object tree.

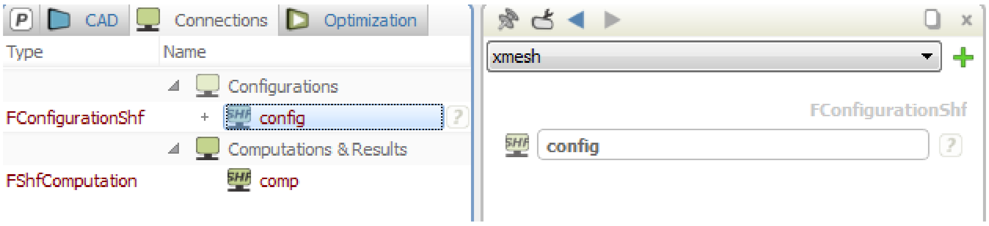


- While the surfaces are selected, choose *CAD* > *surfaces* > *surface group*.
- The initial default name of the created group is “grp1”. In order to have a more meaningful name, let’s name it “hull”.

3 Creation of SHIPFLOW Setup

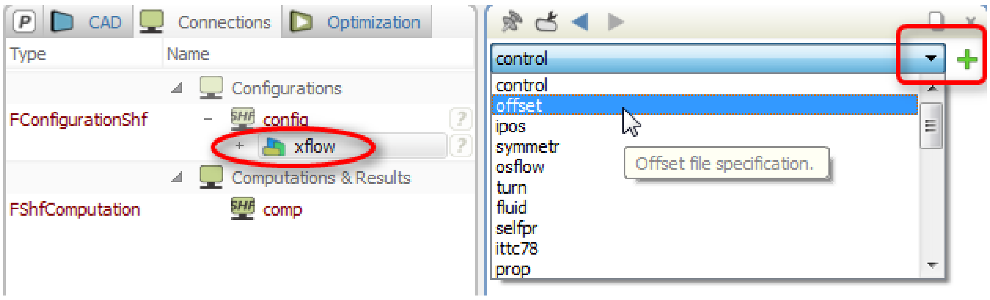
CAESES provides convenient pre-defined setups for *SHIPFLOW* for quick and easy configuration:

- Choose *connections > SHIPFLOW* which creates a *configuration* and a *computation* in the tab *connections*.

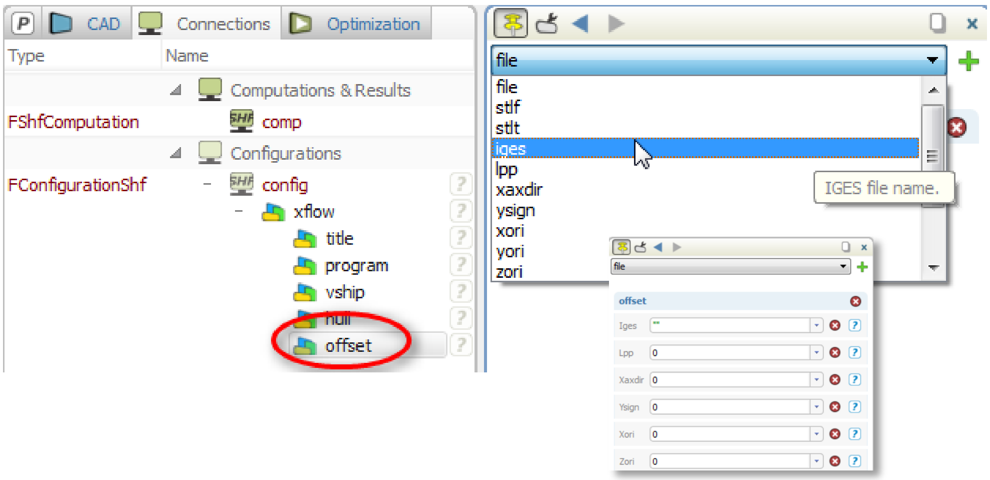


Now, we need to set up the configuration of SHIPFLOW:

- Expand the object "config" in the tree and select *xflow.*
- Choose *offset* from the pull-down menu of the *xflow* entry and press the plus-icon next to the pull-down menu.



- Select the *offset* entry and, in the same manner, add *iges, lpp, xaxdir, ysign, xori* and *zori.*



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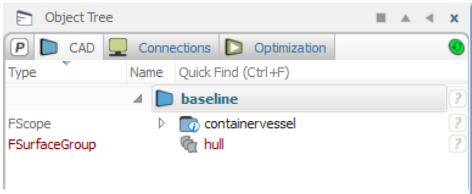
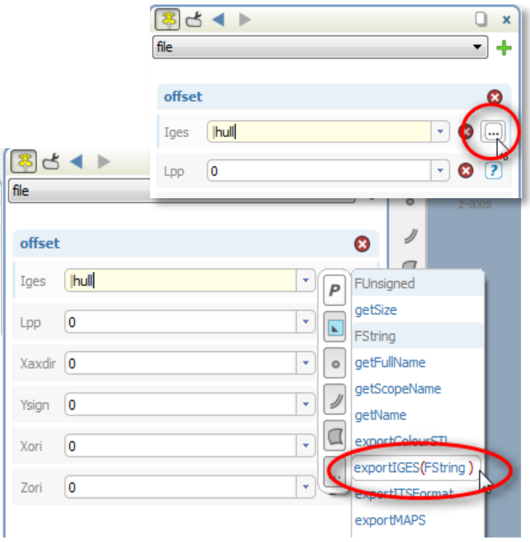
SHIPFLOW Geometry

The created *configuration* and its entries can now be filled with project-related values and geometry:



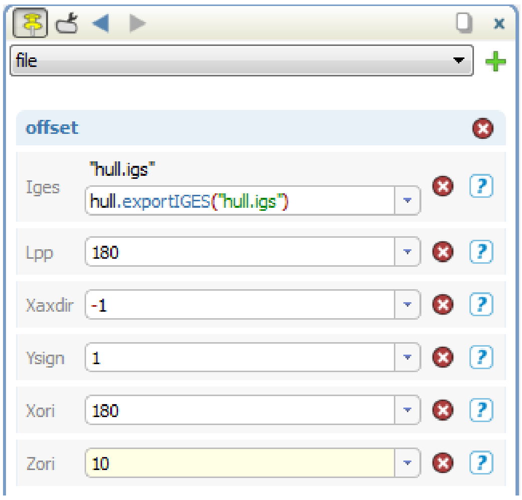


- Click at the *CAD* tab for access to the geometry (the *offset* entry is still pinned).
- Drag and drop the surface group "hull" into the IGES field of the *offset* entry.
- Click at the auto-completion icon ("…") next to the editor field (most upper screenshot).
- Choose *exportIGES(FString)* from the list and set a name for the geometry file.

This command will export all surfaces.

- Enter the remaining values according to the screenshot.

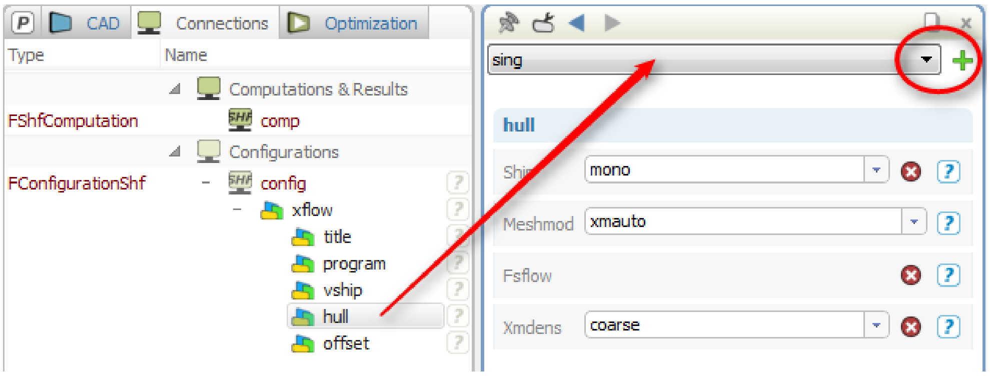
All additional settings are just defining the coordinate system for *SHIPFLOW* computations positioned at forward perpendicular backwards orientated.



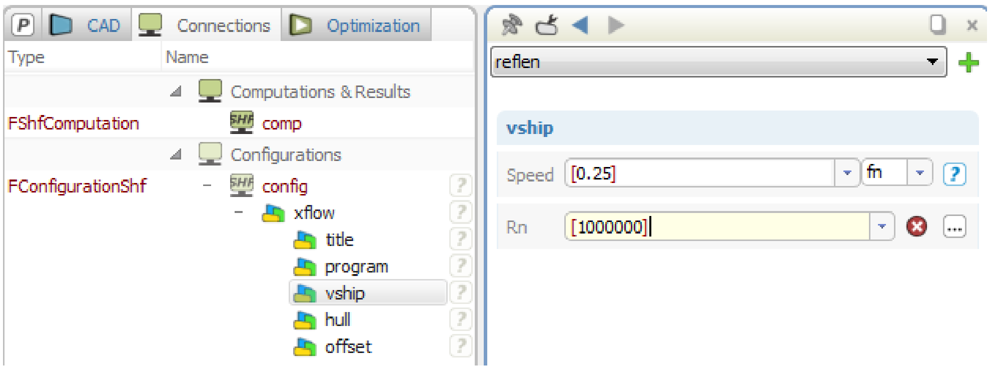
5 SHIPFLOW Main Settings

SHIPFLOW requires settings for defining the ship type (mono hull), an automatic mesh generation, a free water surface (fsflow) and a coarse mesh, due to computational time reduction. For other computations a coarse mesh might not be efficient enough. CFD speed calculations have to be set as well. *Froude* and *Reynolds* numbers are sufficient.

▶ Select the hull entry and add *ship* (“mono”), *fsflow* and *xmdense* (“coarse”):



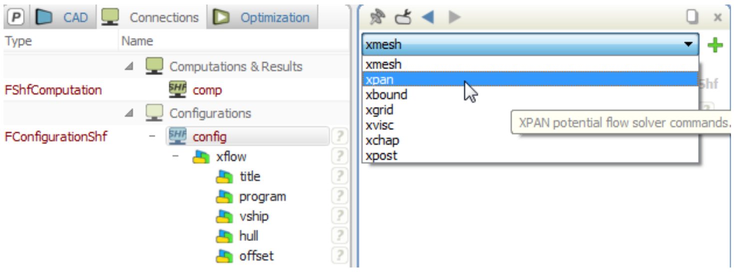
▶ Select the *vhsip* entry and add Reynolds number *Rn* (“1 000 000”):



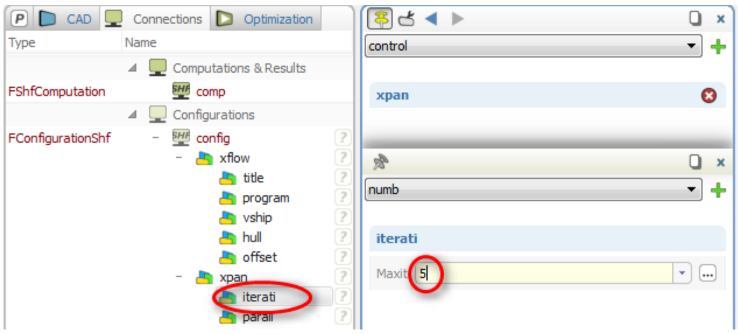
6 SHIPFLOW Adding XPAN

The basic *SHIPFLOW* settings are ready now. This tutorial will describe a quick potential flow analysis. Therefore, XPAN has to be added with a specified number of iterations and cores available for this computation.

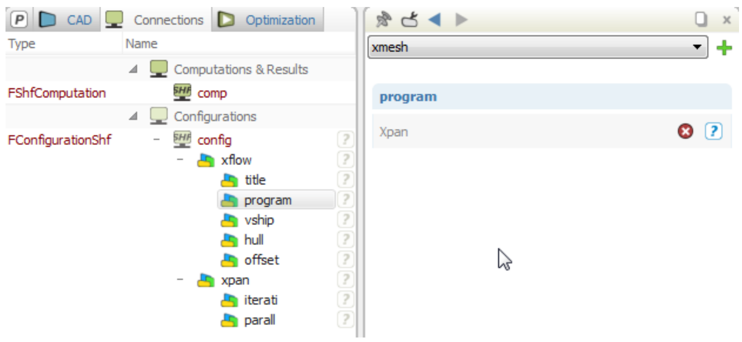
- Select “config” and add *xpan* to the configuration.



- Select *xpan* and set the maximum number of iterations.



- Select the *program* entry of *xflow* in the tree and add *xpan* via the pull-down menu again. This activates the potential flow analysis.

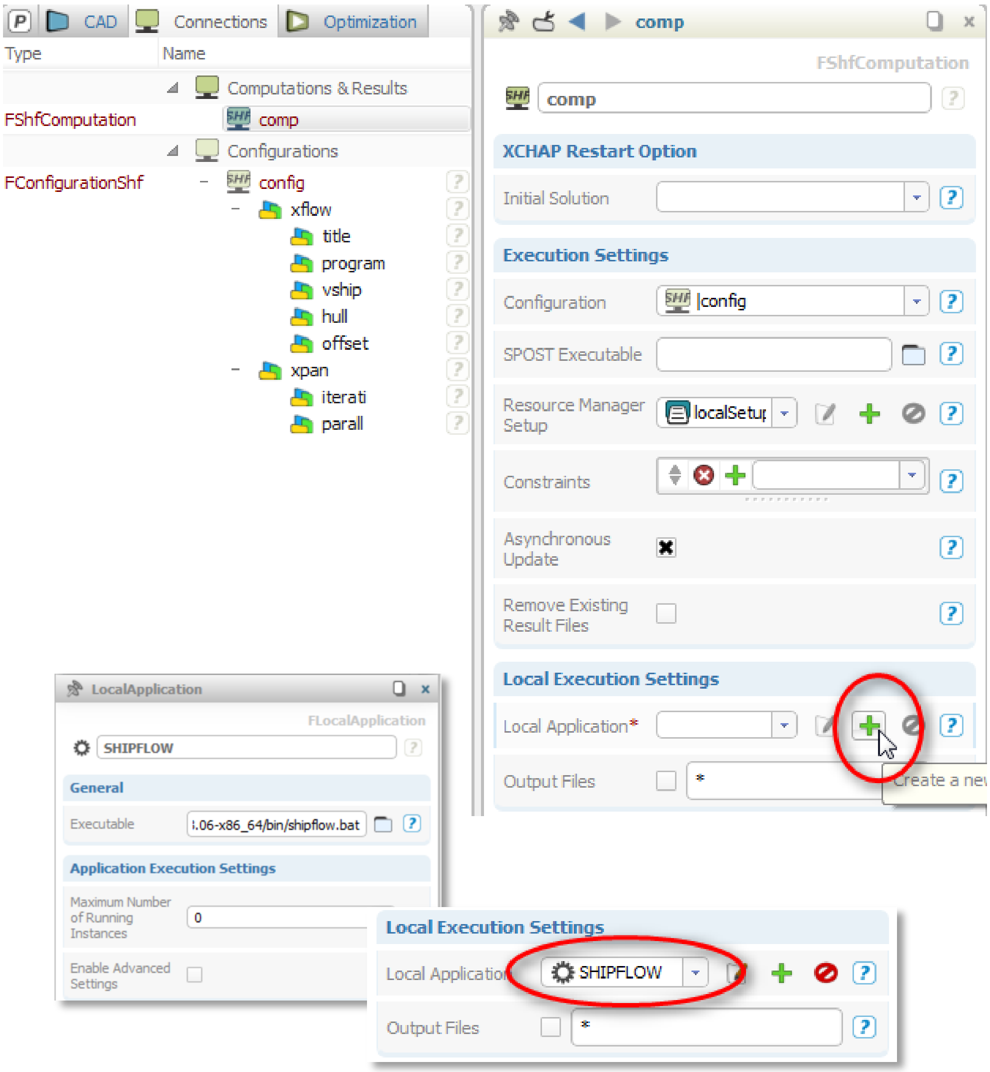


7 SHIPFLOW Computation

The setup is ready now. The last step before running the potential flow analysis is specifying the computation i.e. the object which controls the *SHIPFLOW* executable.

- Select the computation "comp" and add a new local application.
- Set the path to your file "shipflow.bat" from the *SHIPFLOW* installation path.
- Set a meaningful name for the application such as "SHIPFLOW".
- Close the editor of the local application so that only "comp" is given and selected.

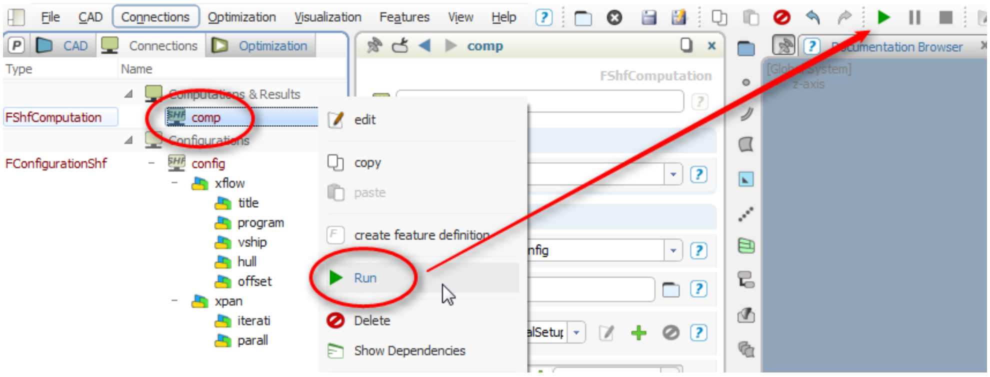
Make sure that finally the new local application is chosen from the pull-down menu.



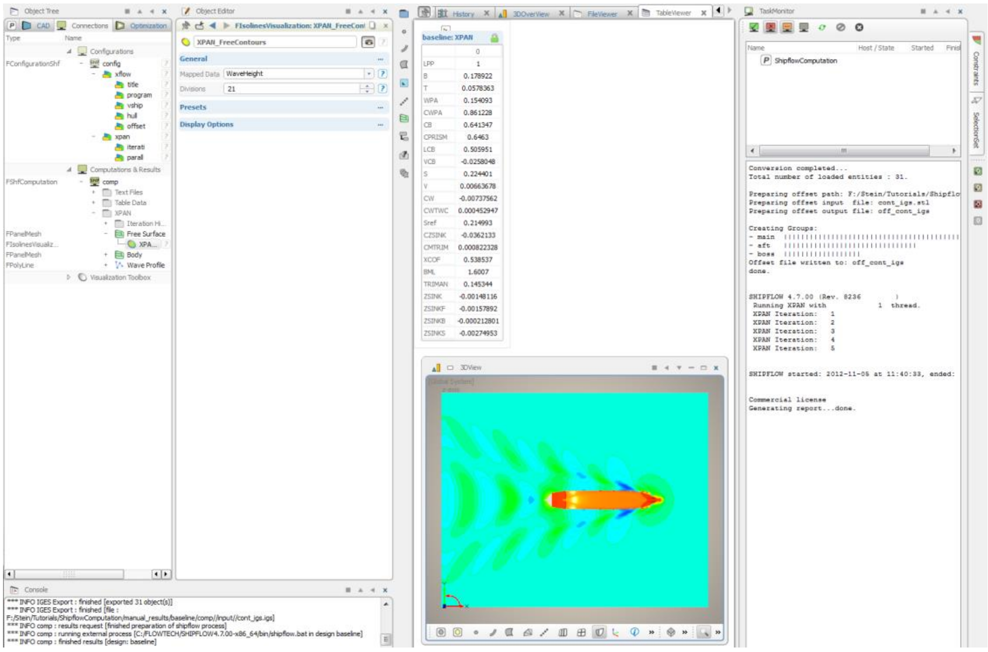
8 Run and Monitor SHIPFLOW

The configuration is ready as well as the computation. Let's run *SHIPFLOW* for the given geometry:

- Select "Run" from the context menu of the computation or from the main toolbar.



The console output of *SHIPFLOW* can be monitored via the "TaskMonitor" widget which is located at the right-hand side of the user interface. It shows the singular steps of calculation, such as preparing offset path, creating offset groups for *SHIPFLOW* and running 5 iterations of XPAN.



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Postprocessing

CAESES allows postprocessing of *SHIPFLOW* results. Calculation results (several flow and resistance coefficients etc.) are provided as well as interactive visualization of the simulation. Please note that there is a separate tutorial for general postprocessing. As a summary, the most important things to know are:

- The “TableViewer” widget shows the key result values from the analysis. In order to extract a table value, double-click on a single table item: A parameter gets automatically created in the tree (*CAD* tab) which monitors this value.
- The visual results such as wave heights of the potential CFD calculation can be observed in the 3D view.
- All results can be accessed and configured right below the computation node in the tree. In this case, all XPAN data is available in the XPAN scope of “comp”.