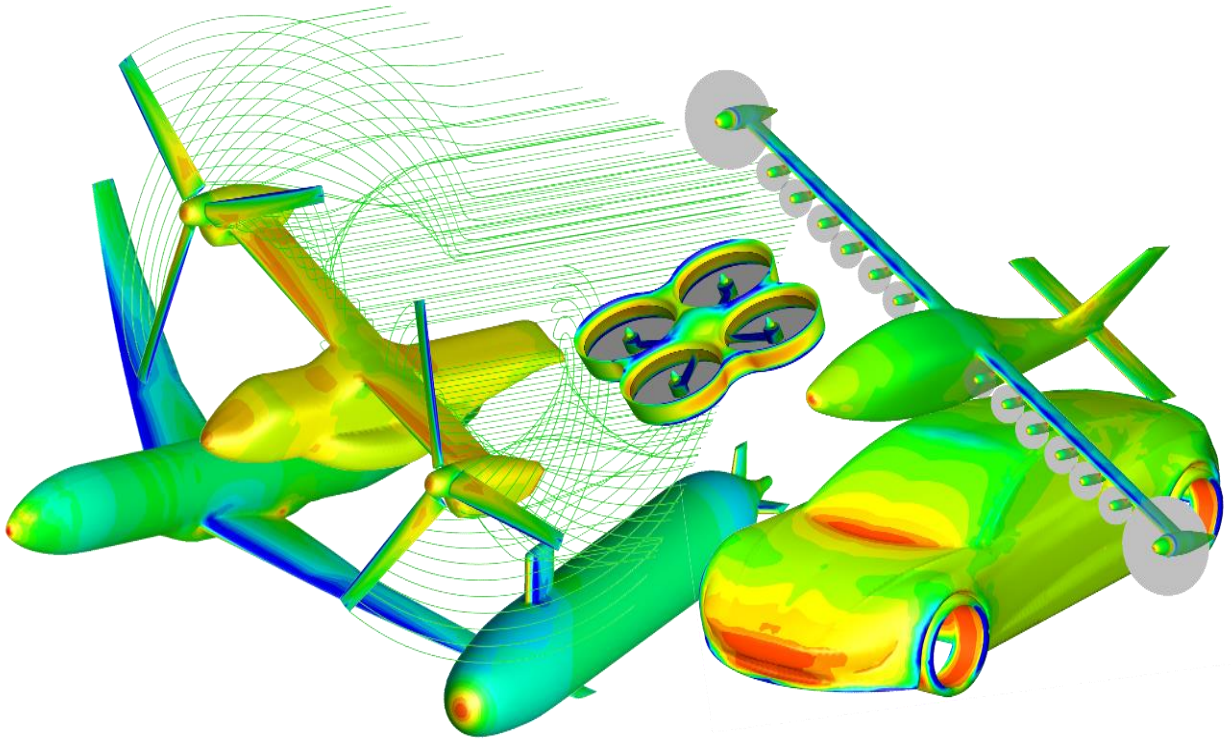
RESEARCH IN FLIGHT



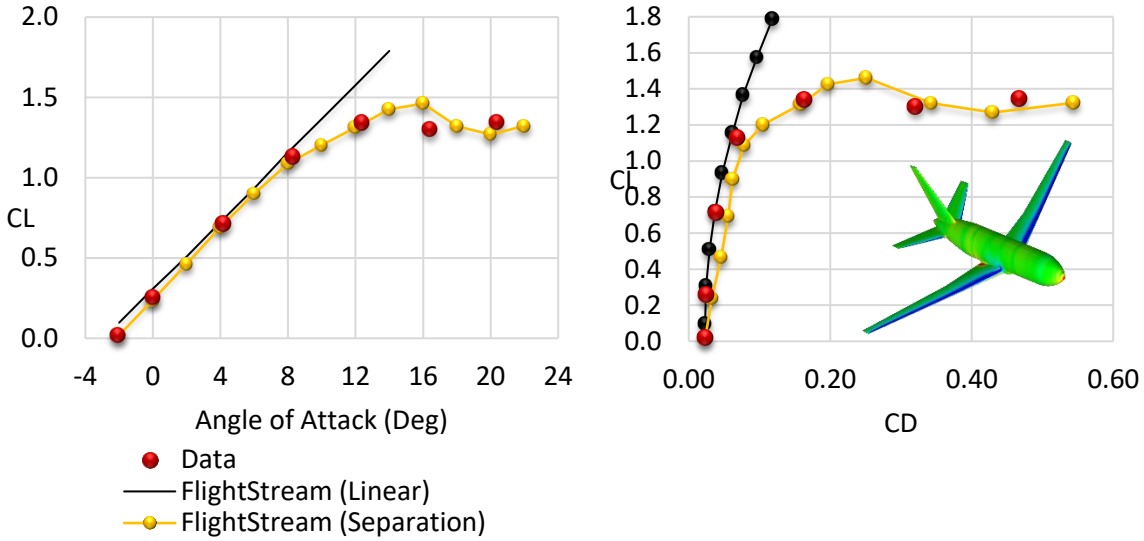
FlightStream 11.4

Release Notes

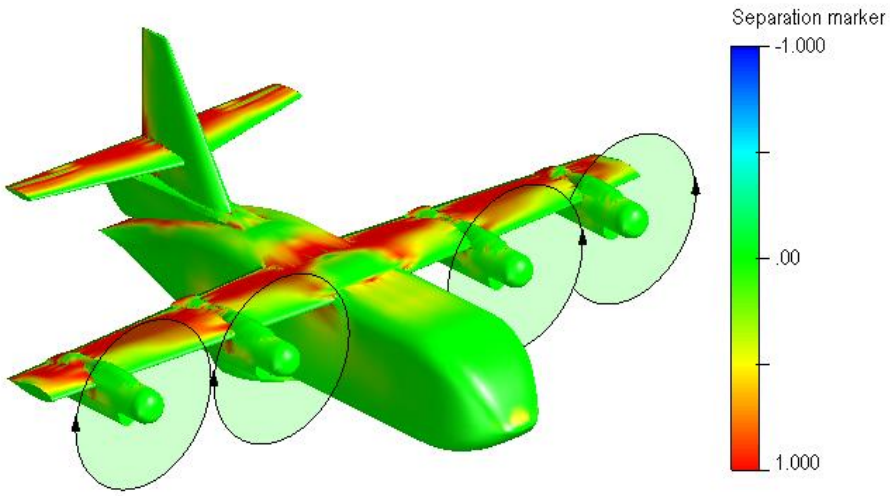
Release Features

Relaxed Kutta Separation Modeling

A powerful new feature in FlightStream® 11.4 is the addition of the new Relaxed Kutta Flow Separation model to the solver analysis tools. This new feature expands on the Vorticity-based separation model of FlightStream® 11.2 (which allowed for the prediction of CL_{MAX} and post-stall lift forces only) to include all post-stall forces and moments, as shown below for the NASA EET-AR-12 aircraft geometry. The new model also works with propeller actuators and jet exhaust actuators in FlightStream®, thereby allowing the extension of the Relaxed Kutta Separation modeling to the analysis of aero-propulsive systems.

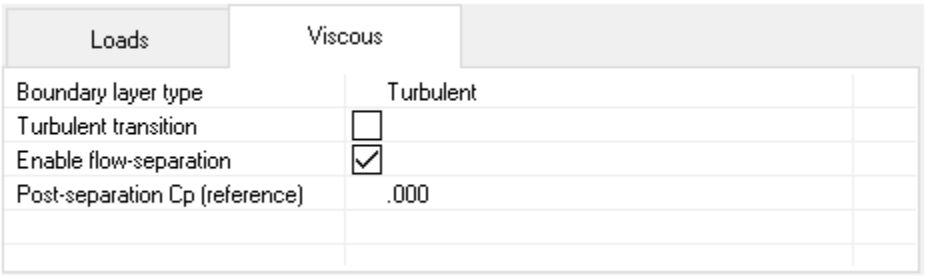


This feature also allows users to plot the locations of flow separation on the surfaces of the geometry (as shown below for the NASA XC-142 Quad-rotor VTOL aircraft), and to use this contour field variable within a trade-study tool.

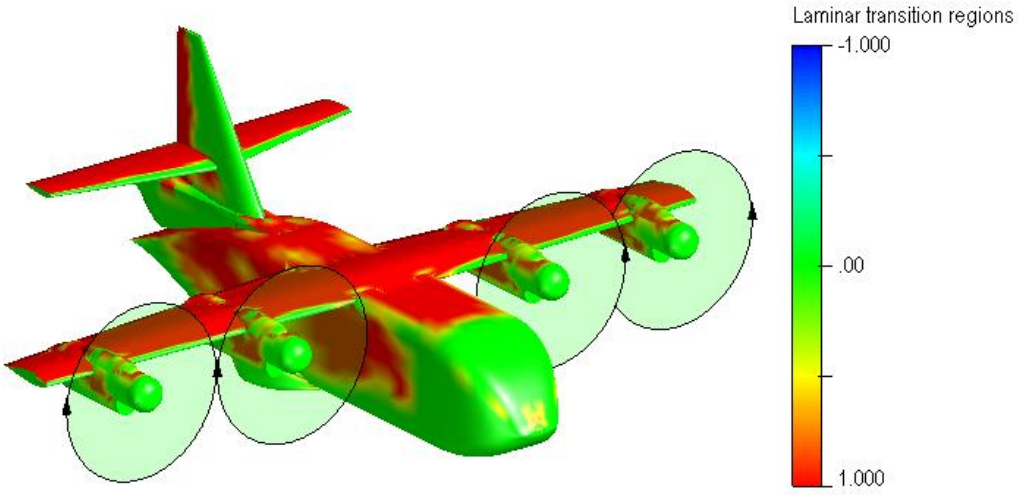


Boundary Layer Transitions: Improved Viscous Forces Model

A new model for the prediction of boundary layer transition has been added to FlightStream® 11.4. This transition model, based on the work done by Dvorak and Curle has been added to the viscous tools in FlightStream® and allows users to compute the boundary layer transition locations on the geometry based on local surface flow conditions and boundary layer parameters.

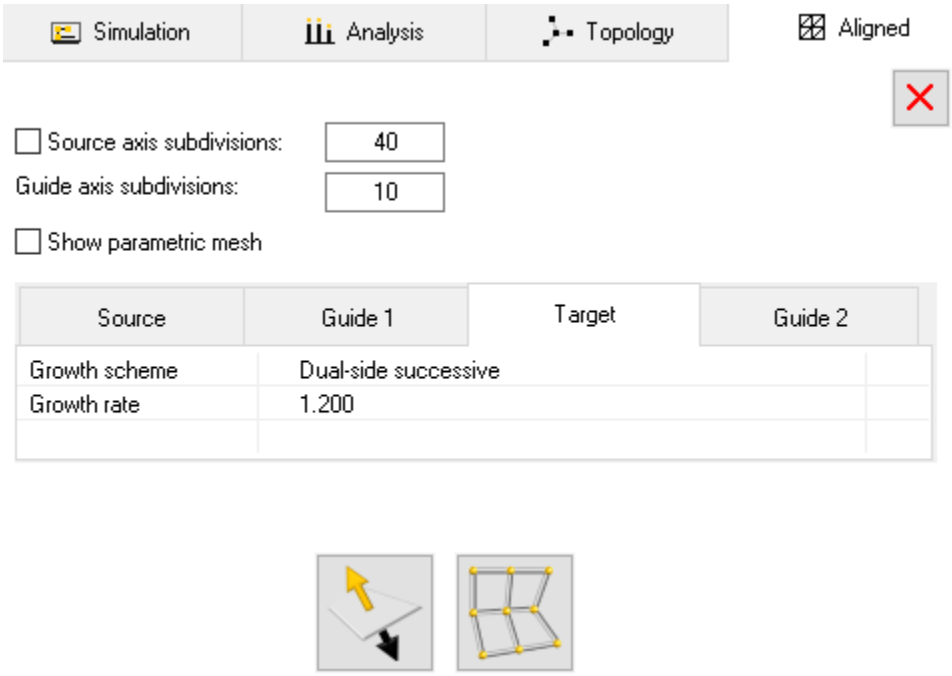


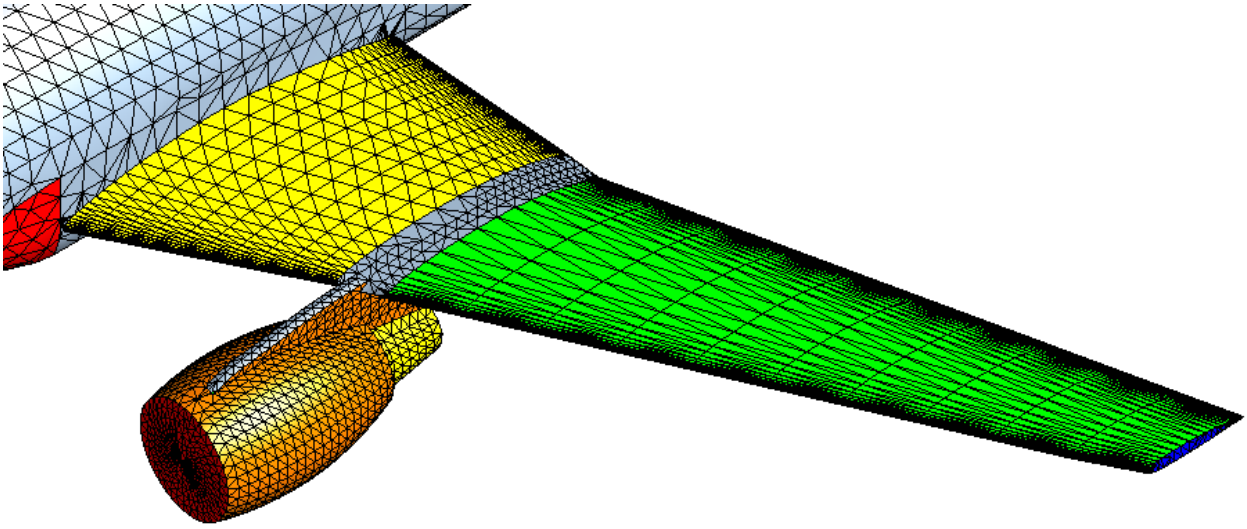
The resulting transition locations are shown as a normalized contour variable with a range of 0 (Laminar) to 1 (Turbulent), as shown for the NASA XC-142 geometry below in FlightStream®:



Advanced Aligned Mesher For Anisotropic Quad Meshes

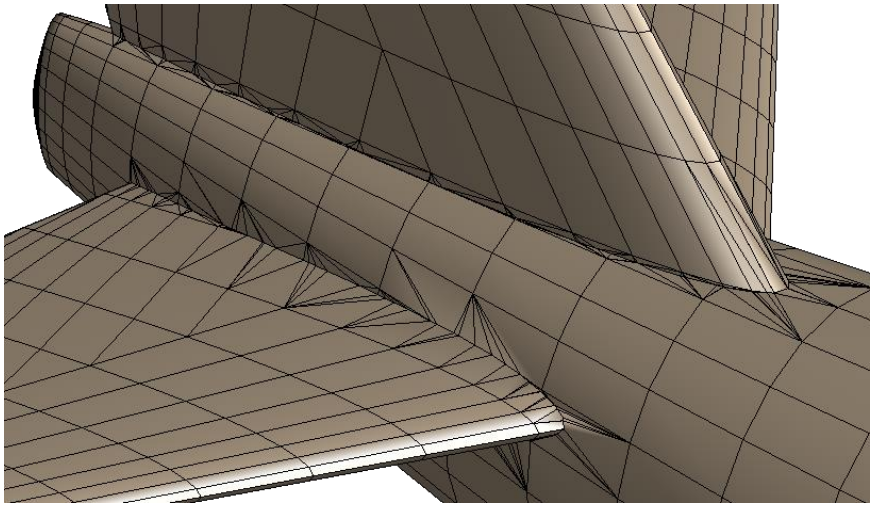
The aligned mesher in FlightStream® 11.4 has been substantially enhanced to include users to generate anisotropic quad meshes with very high turnaround speeds on complex non-four-sided CAD faces. The new mesher automatically computes curve subdivisions based on curve lengths, thereby freeing the user from having to make these specifications. Consequently, the new aligned mesher now has only four curves for the user to specify growth settings on: source, target and the two connecting guide curves. The UI has been consolidated into the Aligned Mesher pane as shown below. The aligned mesher settings are now also perpetual, thereby allowing users to maintain the same settings for different CAD faces, further reducing the turnaround time on generating meshes on different faces.



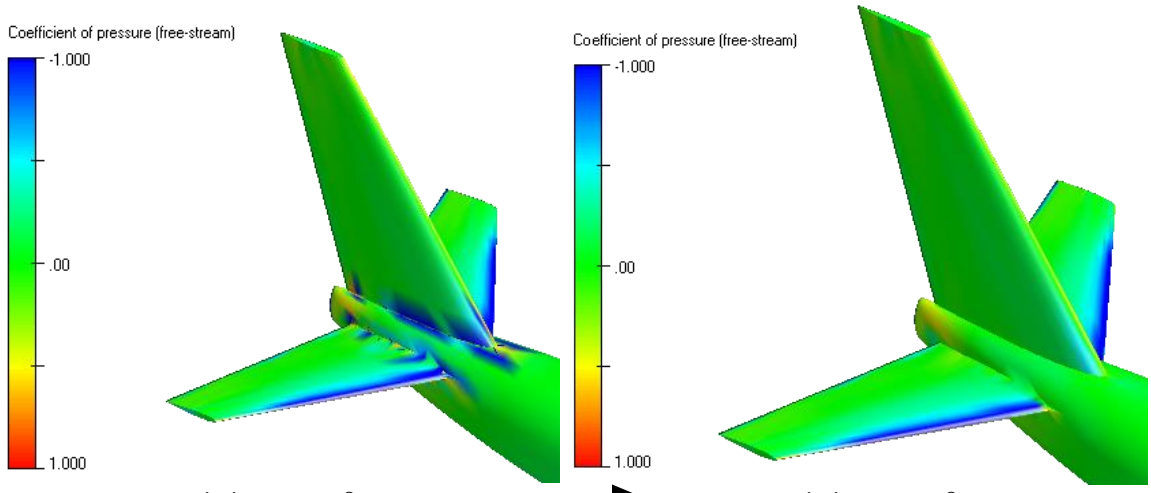


Automated Pressure-Spike Cleanup

FlightStream® 11.4 deploys a new mesh face-quality metric that effectively captures the location of all low-quality pressure spikes on the mesh during the solver run. This face quality metric is available as a solver contour variable, allowing users to now check the quality of their mesh prior to running the solver to determine the location of poor quality faces that will cause pressure spikes. This new face quality metric is now coupled with the solver in an auto-cleanup tool that automatically remediates the local surface vorticity distributions to account for the poor mesh quality. This vorticity remediation resolves all local flow-field spikes in velocity, pressure and Mach number. An example is shown here for a surface mesh that has very low aspect-ratio mesh faces near the component junctions:



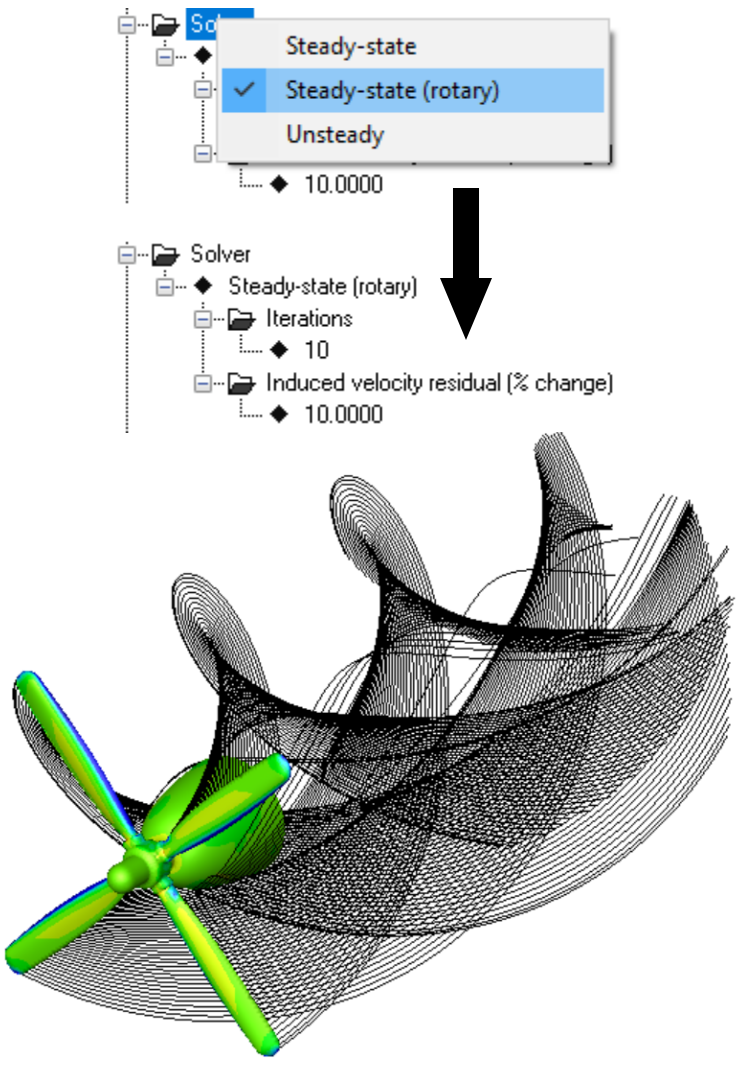
The resulting pressure spikes are shown in the image below. The new auto-cleanup tool in FlightStream® 11.4 is shown in the image below (right), with the improvements in the solution as a result of the automated vorticity remediation:



FlightStream® 11.2 → FlightStream® 11.4

Steady-state rotary solver for Hover

A new solver mode has been added to FlightStream® 11.4 to allow users to perform analysis on steady-state rotation of propellers for hover and vertical flight conditions. The new solver model computes the induced velocities of the rotor/propeller and automatically modifies the local blade boundary conditions until convergence is achieved. This model allows users to now use FlightStream® 11.4 to compute blade loads and power requirement for hover conditions in both single blade and multi-blade systems.



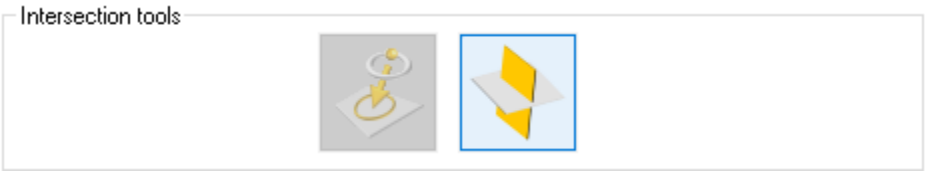
Enhancements

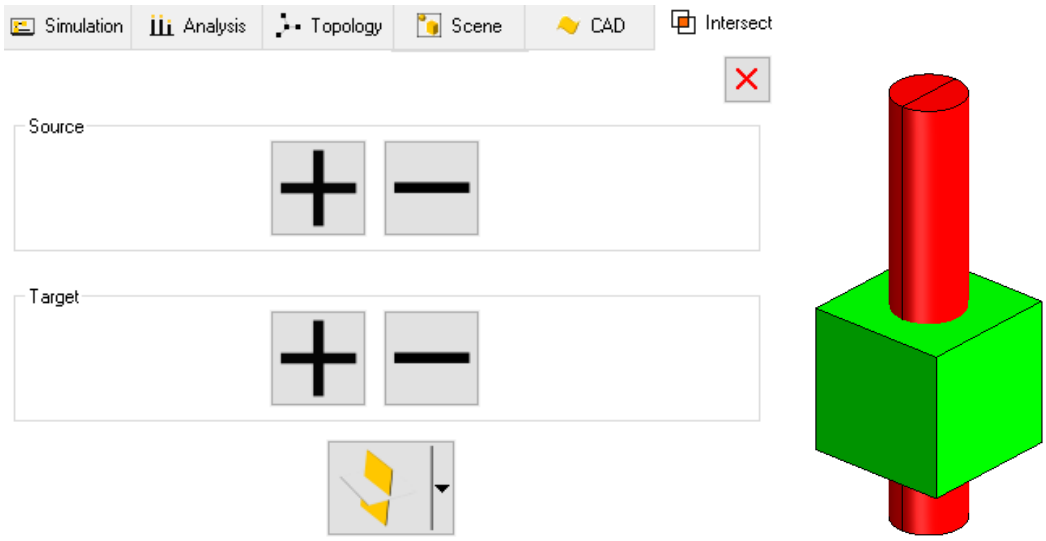
Extended IGES entities and CAD Solids Import

FlightStream® 11.4 enhances the CAD import capabilities in FlightStream® to allow users to now import the Extended IGES entities and solids as part of their CAD models. The new solids include Manifold Solid B-Rep objects, shells and face lists. Additionally, this enhancement covers all supported extended IGES surface entities.

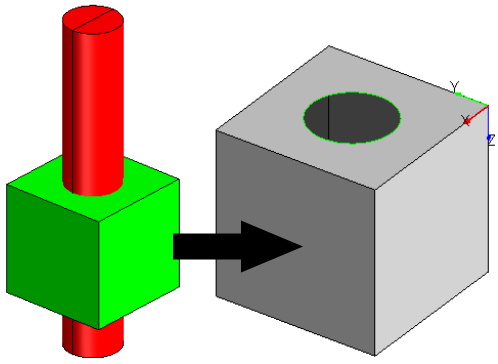
Enhanced CAD Create Intersection Tools

FlightStream® 11.4 enhances the CAD Create Intersection tools by enabling sheet-sheet intersections or body-body intersections. The intersection tool now allows users to create 3D drawing curves corresponding to the intersection between two CAD face groups: source (red) and target (green) that are selected by the user from the new Intersect panel within the CAD Create tools panel:



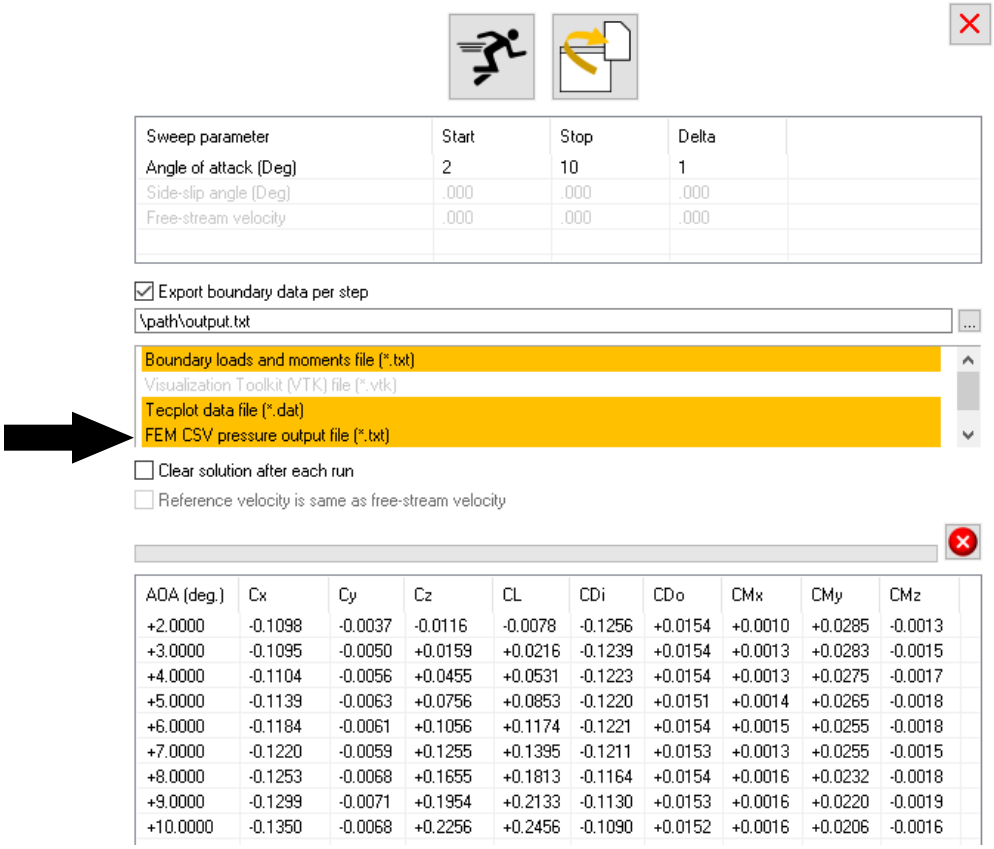


The resulting drawing curves from the intersect operation can then be used to imprint a closed loop of curves on to the target faces as shown for the sample case here. This capability can be used to repair CAD models that involve self-intersections as well as to create new complex bodies from simpler individual components.



New Solver Sweeper Toolbox Export Options for FEA

FlightStream® 11.4 enhances the Solver Sweeper Toolbox to allow exporting of surface pressure output files for every solver run inside the sweep. These pressure files are exported in formats read by all commercial Finite Element Analysis (FEA) solvers and allows automated generation of large aerodynamic loads and moment distributions for structural analysis. This feature is also supported via the FlightStream® 11.4 scripting API enhancements, allowing for a robust, automated integration with the structural analysis.



AOA (deg.)	Cx	Cy	Cz	CL	CDi	CDo	CMx	CMy	CMz
+2.0000	-0.1098	-0.0037	-0.0116	-0.0078	-0.1256	+0.0154	+0.0010	+0.0285	-0.0013
+3.0000	-0.1095	-0.0050	+0.0159	+0.0216	-0.1239	+0.0154	+0.0013	+0.0283	-0.0015
+4.0000	-0.1104	-0.0056	+0.0455	+0.0531	-0.1223	+0.0154	+0.0013	+0.0275	-0.0017
+5.0000	-0.1139	-0.0063	+0.0756	+0.0853	-0.1220	+0.0151	+0.0014	+0.0265	-0.0018
+6.0000	-0.1184	-0.0061	+0.1056	+0.1174	-0.1221	+0.0154	+0.0015	+0.0255	-0.0018
+7.0000	-0.1220	-0.0059	+0.1255	+0.1395	-0.1211	+0.0153	+0.0013	+0.0255	-0.0015
+8.0000	-0.1253	-0.0068	+0.1655	+0.1813	-0.1164	+0.0154	+0.0016	+0.0232	-0.0018
+9.0000	-0.1299	-0.0071	+0.1954	+0.2133	-0.1130	+0.0153	+0.0016	+0.0220	-0.0019
+10.0000	-0.1350	-0.0068	+0.2256	+0.2456	-0.1090	+0.0152	+0.0016	+0.0206	-0.0016

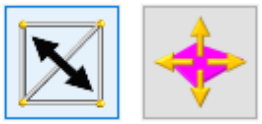
Stability & Control Toolbox: Dynamic Derivatives for Separated Flows

FlightStream® 11.4 enhances the capabilities of the Stability & Control Toolbox with the deployment of a new unsteady-vorticity model for the dynamic stability derivatives for both lateral and longitudinal modes.

This new capability works in conjunction with the new Relaxed Kutta separation model in the solver to compute stability coefficients for separated flows and base areas. This feature is also supported via the FlightStream® 11.4 scripting API enhancements.

Automated Mesh Quality Improvement Tool

Another enhancement to the Mesh Repair tools in FlightStream® 11.4 is the addition of an automated mesh quality improvement tool. This tool allows users to select mesh faces and instantly improve their quality by clicking this function. The function works by swapping edges and therefore retains all existing vertices (and consequently the fidelity of the mesh). The overall number of mesh faces also remain unaffected. This tool simply restructures the mesh topology to improve net quality of the mesh.

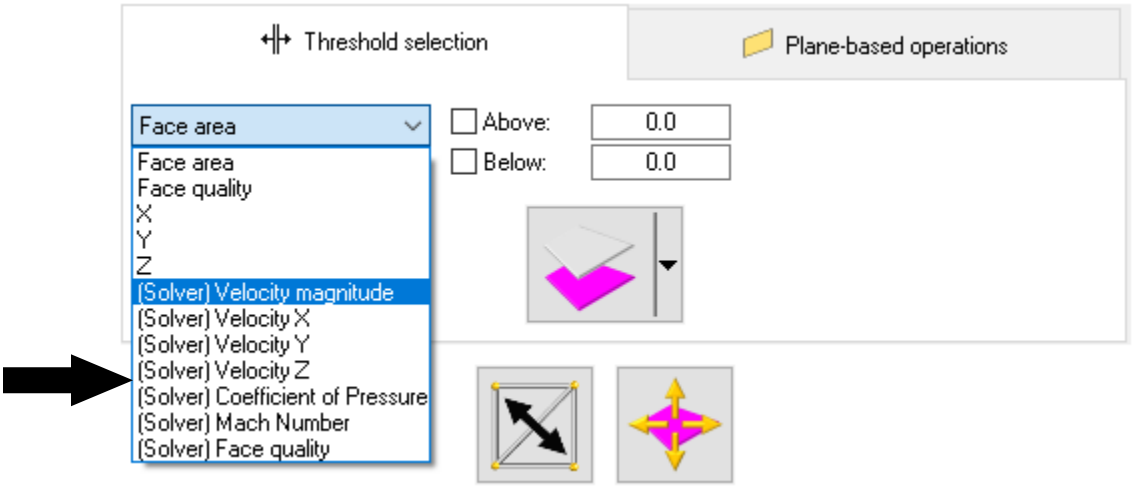


Solver Field Parameter Threshold Selection Options

FlightStream® *11.4 expands the list of available parameters that can be used for threshold-based mesh selection in the Topology pane for the mesh. The new parameters include the following solver fields:*

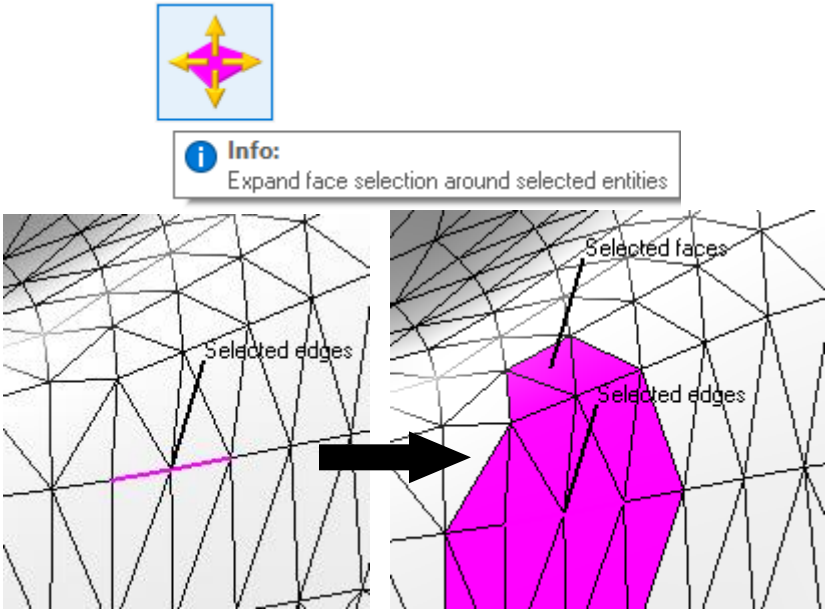
1. *Surface velocity magnitude*
2. *Surface velocity components*
3. *Coefficient of surface pressure*
4. *Surface Mach Number*
5. *Solver Face Quality*

These parameters can be used when the solver is initialized, to select locations of poor mesh quality, or locations of pressure spikes resulting from poor mesh quality. The selected mesh faces can then easily be remediated using existing repair tools.



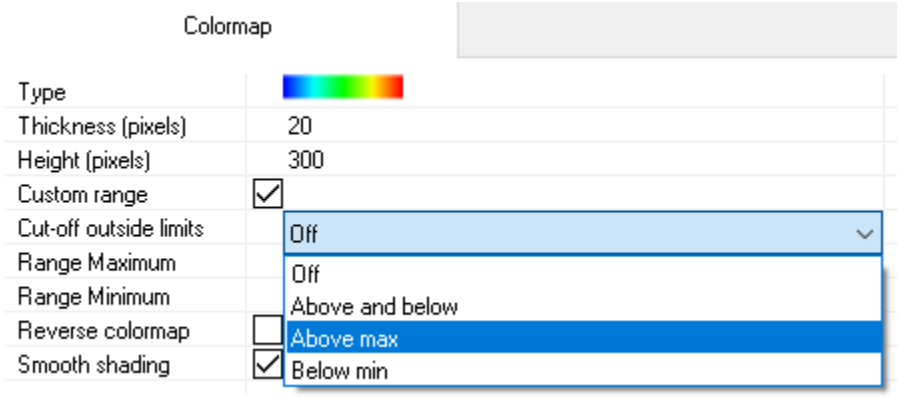
Expanded Selection Tools

Another new tool in the Topology and mesh diagnostics pane in FlightStream® 11.4 allows users to now grow selection of mesh faces iteratively around other selected entities, such as selected edges and vertices. This can be used in conjunction with the mesh diagnostics selection tools to select and then expand face selection around mesh locations needing cleanup.



Solver Color-map Range Cut-off Tools

FlightStream® 11.4 scene settings tools now allow users to determine if the contour color-map values should be cut-off (clipped) above or below a user-defined range of values. Users can choose whether they wish to clip only the upper or lower bounds, or both bounds based on the custom settings.



Updated scripting API

The scripting API has been updated to allow access to all of the new features and enhancements for FlightStream® 11.4.

Fixes

IGES CAD planes parameterization

FlightStream® 11.4 has fixed issues related to the parameterization of CAD plane surfaces for imported CAD models.

IGES CAD Surface Duplication

Fixes have been added to FlightStream® to allow import of IGES models that involve duplicated CAD surfaces when exported from the source software to FlightStream®.

Miscellaneous bug fixes

FlightStream® 11.4 features many minor fixes to bugs reported with version 11.2.

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