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Altair AcuSolve：新機能紹介

October 14, 2021

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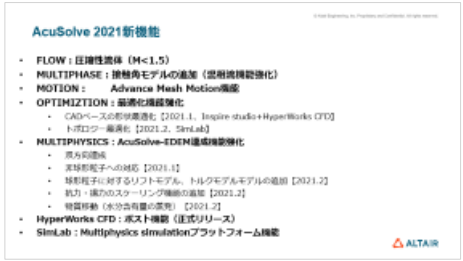

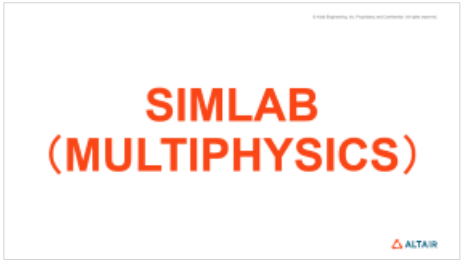

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AcuSolve 2021新機能

- **FLOW：圧縮性流体（M<1.5）**
- **MULTIPHASE：接触角モデルの追加（混相流機能強化）**
- **MOTION：　　Advance Mesh Motion機能**
- **OPTIMIZTION：最適化機能強化**
  - CADベースの形状最適化【2021.1、Inspire studio+HyperWorks CFD】
  - トポロジー最適化【2021.2、SimLab】
- **MULTIPHYSICS：AcuSolve-EDEM連成機能強化**
  - 双方向連成
  - 非球形粒子への対応【2021.1】
  - 球形粒子に対するリフトモデル、トルクモデルモデルの追加【2021.2】
  - 抗力・揚力のスケーリング機能の追加【2021.2】
  - 物質移動（水分含有量の蒸発）【2021.2】
- **HyperWorks CFD：ポスト機能（正式リリース）**
- **SimLab：Multiphysics simulationプラットフォーム機能**

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FLOW

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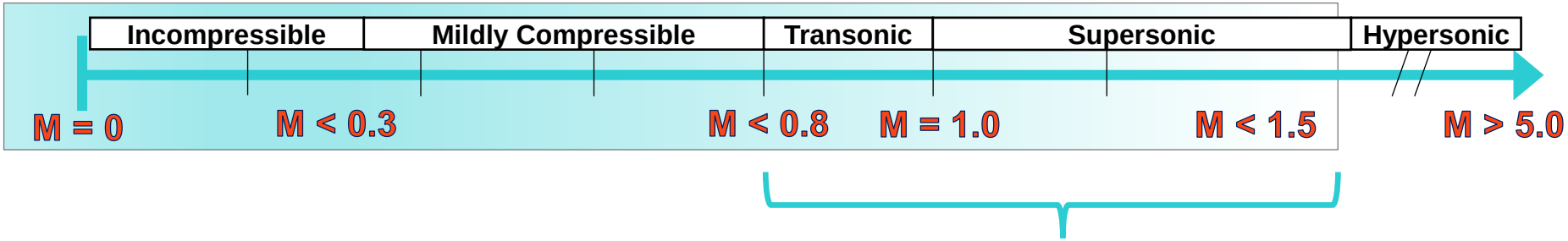
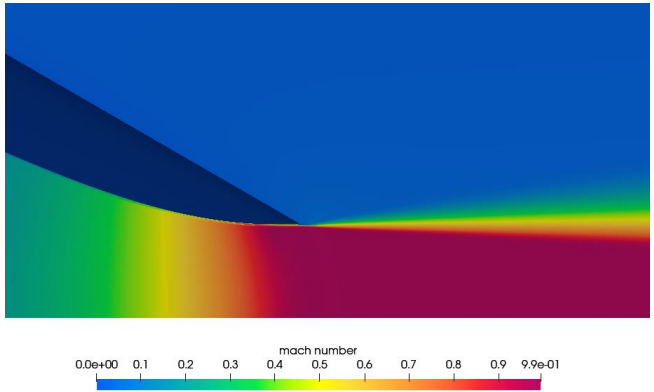
圧縮性流体

- AcuSolveの対応可能なマッハ数が広がりました



2021で拡大範囲



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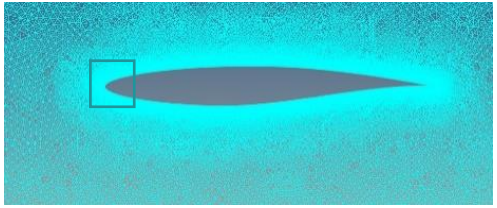
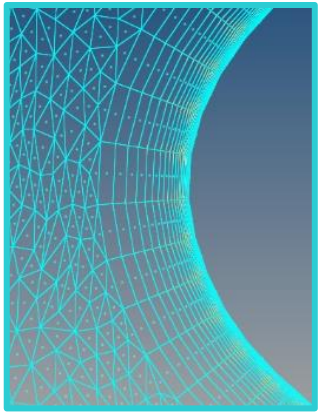
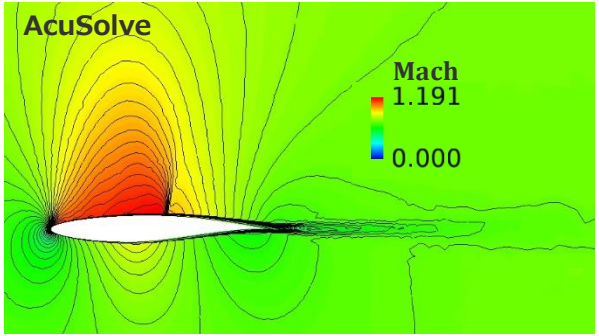
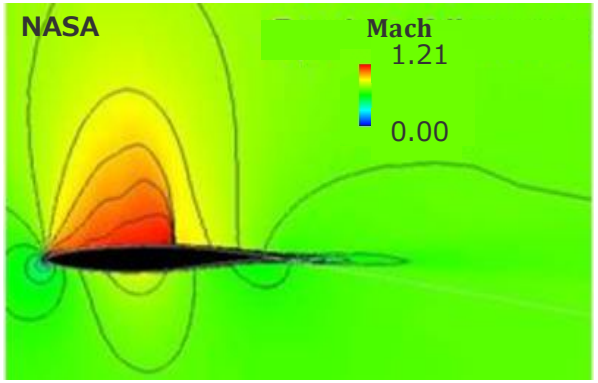
圧縮性流体

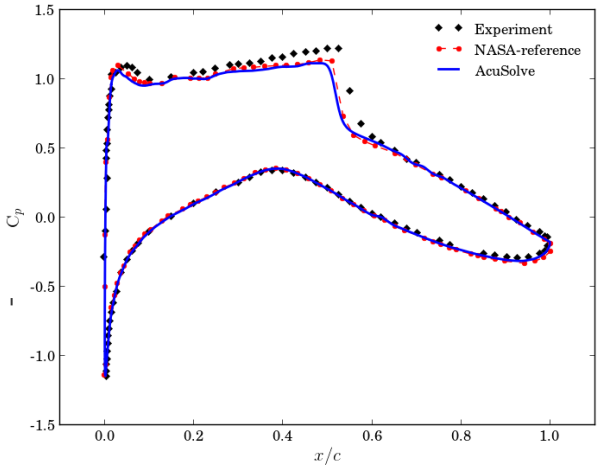
- External Viscous Flow: RAE 2822











$M_\infty = 0.729$

$\alpha = 2.31°$

$Re = 6.5 \times 10^6$

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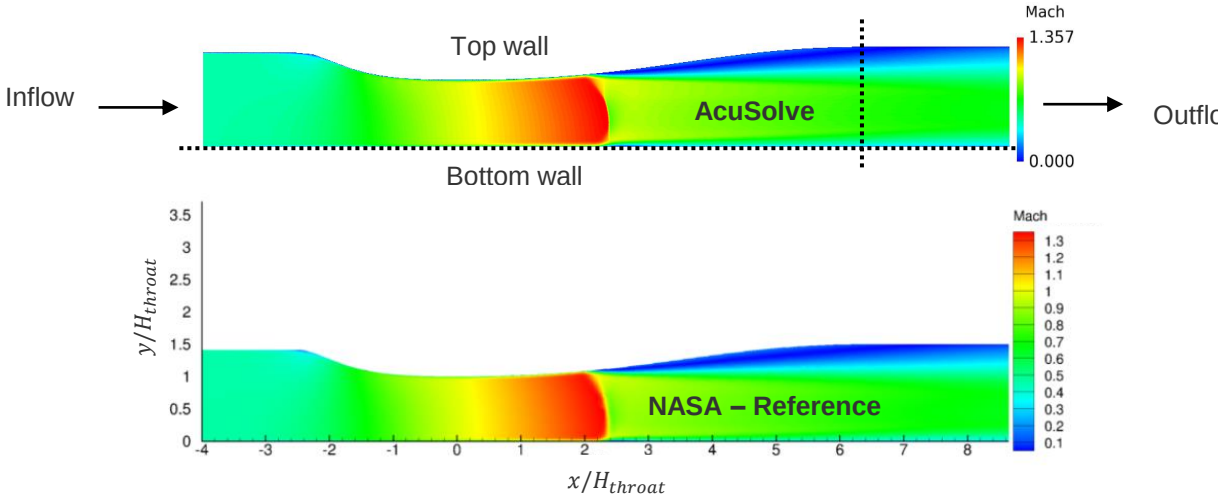
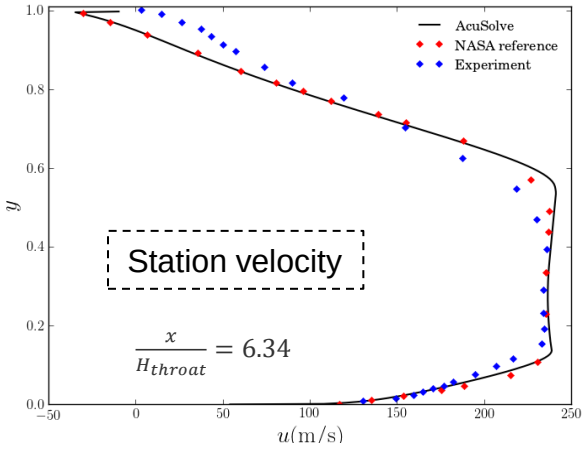
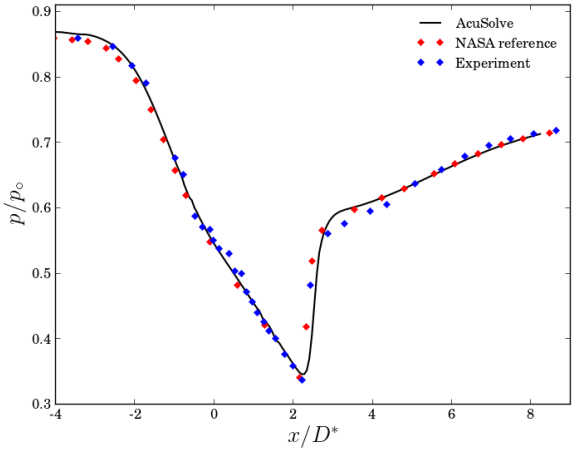
圧縮性流体

- Sajben transonic diffuser – SA turb. Model
  - $\mathrm{M}_{\mathrm{inflow}} = 0.46,\ \ p/p_0 = 0.865,\ \ T/T_0 = 0.9594$
- 本モデルは、Validation Manualに含まれています







Pressure along bottom wall

References

Bogar, T. J., Sajben, M., and Kroutil, J. C. (1983) "Characteristic Frequencies of Transonic Diffuser Flow Oscillations," AIAA Journal, Vol. 21, No. 9, pp. 1232-1240

Mohler, S.R., "Wind-US Unstructured Flow Solutions for a Transonic Diffuser," NASA CR-2005-213417, January 2005

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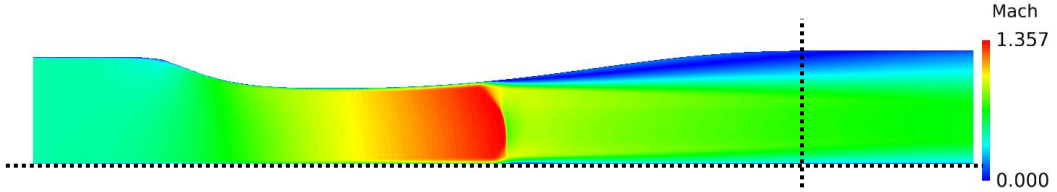
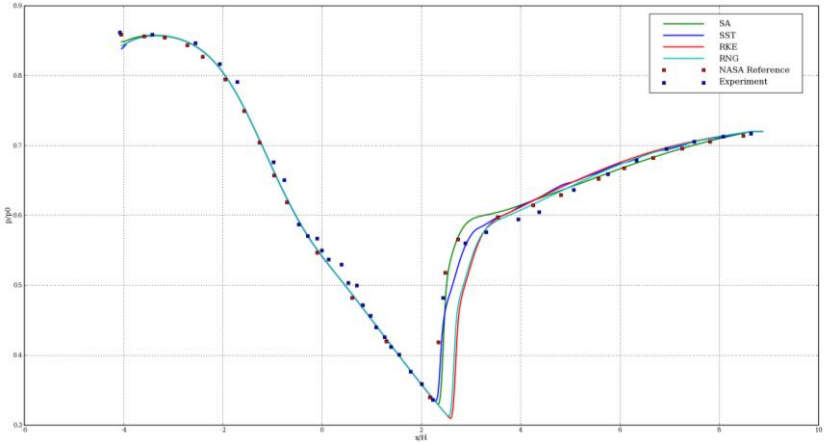
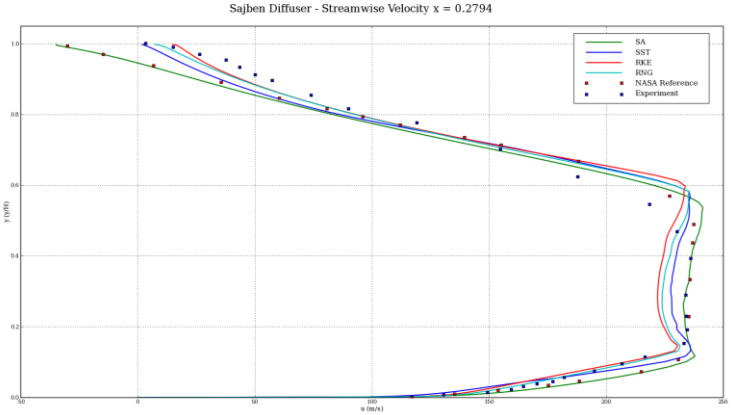
圧縮性流体

- 乱流モデルへの対応
  - 全ての乱流モデルをサポート
  - 最初のトライでは、Spalart-Allmaras を利用することを推奨
  - SST / RKE ➡ 再循環領域の精度が向上





Pressure along bottom wall



Station velocity

SA
SST
RKE
RNG
NASA Reference
Experiment

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MULTIPHASE

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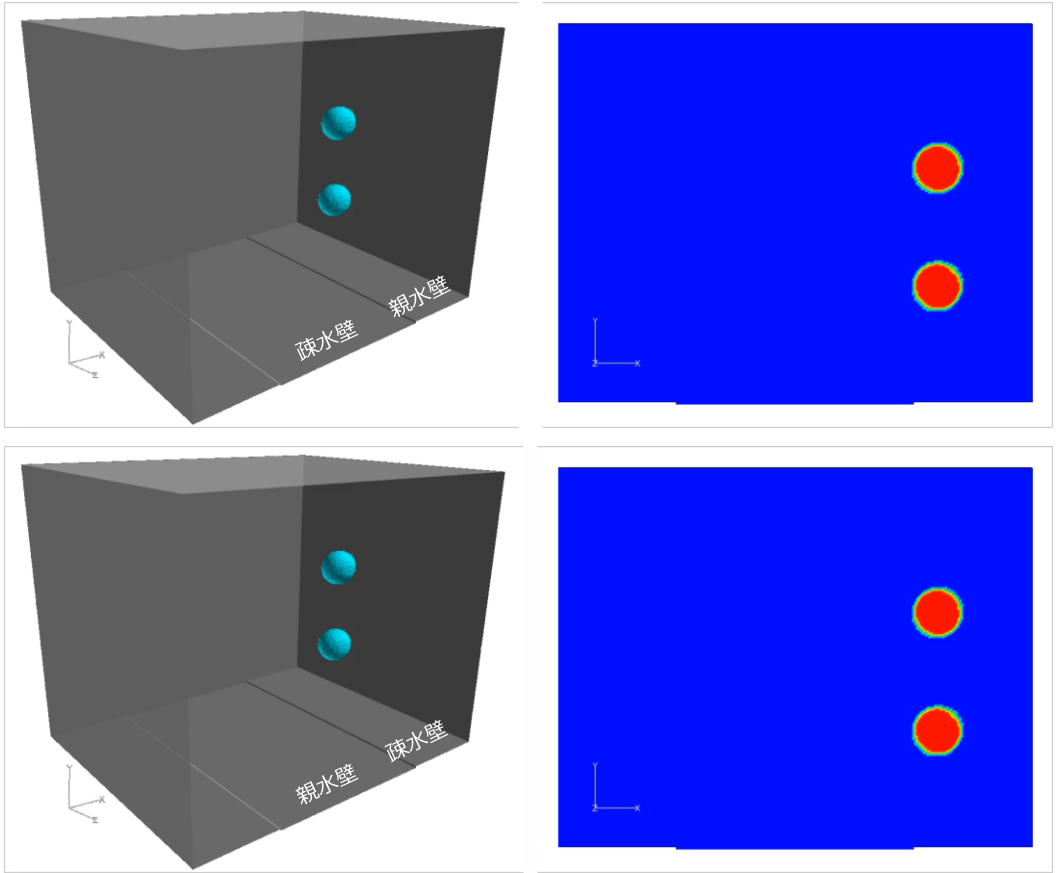
接触角モデルの追加

- 混相流（Level-Set）の機能強化
  - 接触角が重要な問題に対応
  - 壁面毎に親水/疎水を定義可能



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MOTION

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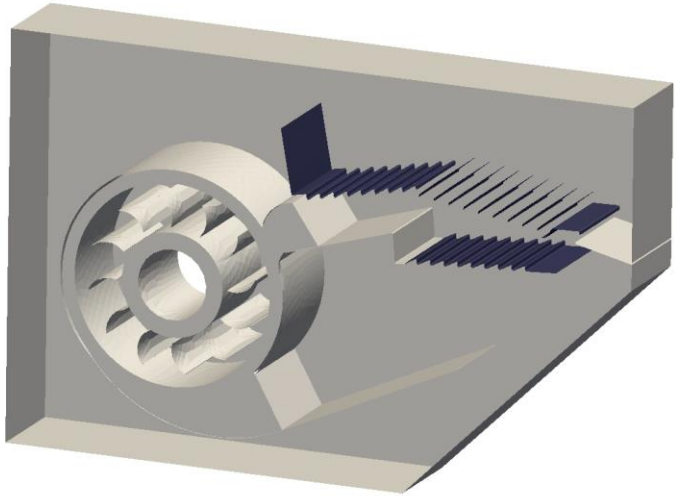
Advance Mesh Motion機能

- ２つの参照点の時刻歴データで移動パスを定義
- 並進（translation）と回転（rotation）を組み合わせた移動問題が計算可能



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OPTIMIZATION

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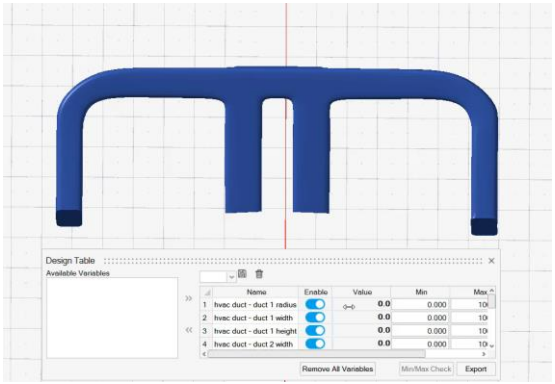
CADベースの形状最適化（HyperWorks CFD）

2021.1

- Inspire studio＋HyperWorks CFD＋HyperStudyを組合せた最適化
- 形状を、Inspire Studioで変更し、メッシュ生成➡AcuSolve実行までに一連の処理を HyperWorks CFDのTemplate機能で制御

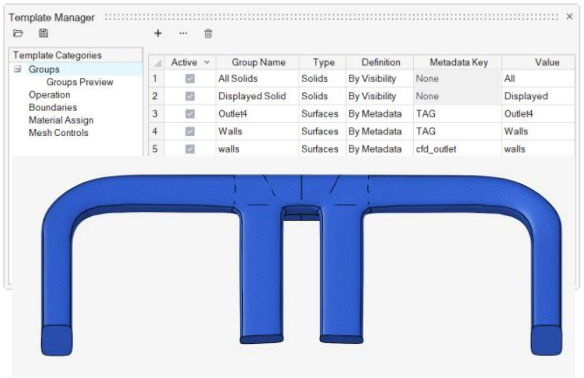
Inspire Studio

- Define CAD design space and design variables



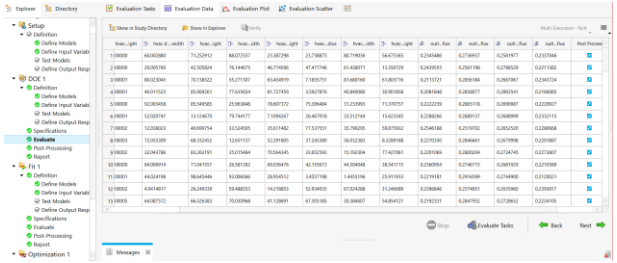
HyperWorks-CFD

- Define automation template
- Generic tcl script which call the template in batch mode
- .bat file to execute HWCFD, AcuSolve



HyperStudy

- Setup DOE, Fit, Optimization studies



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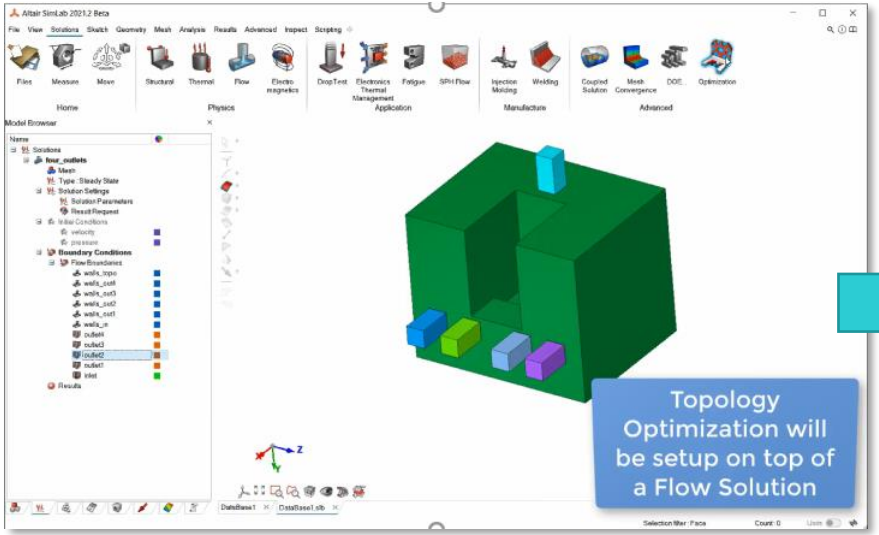
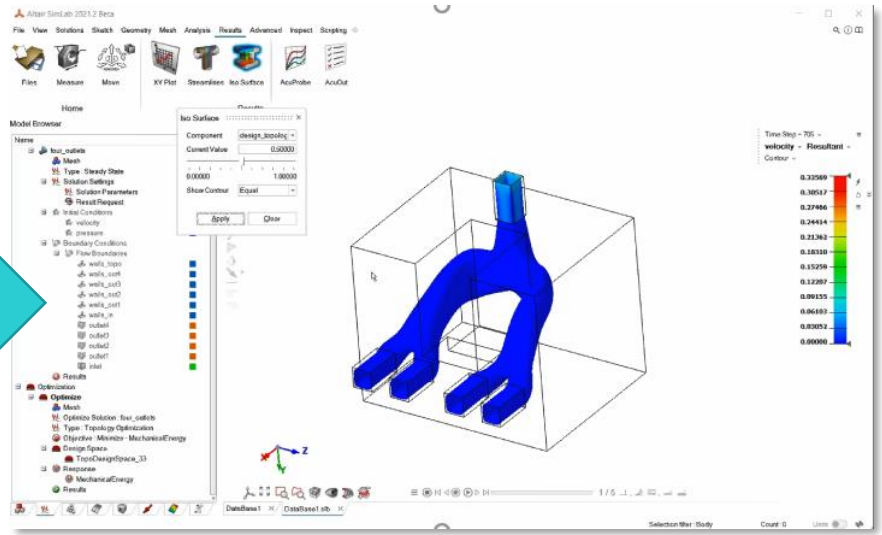
トポロジー最適化（SimLab）

2021.2

- 抵抗が最小となる形状を探索
- SimLabでのみサポート



初期設計空間（緑）



最適形状

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MULTIPHYSICS

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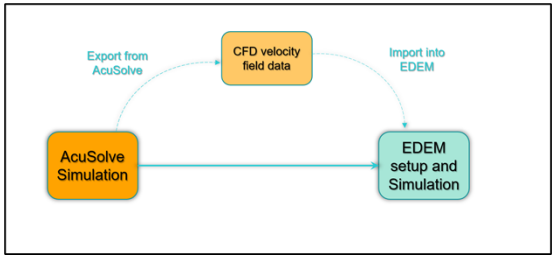
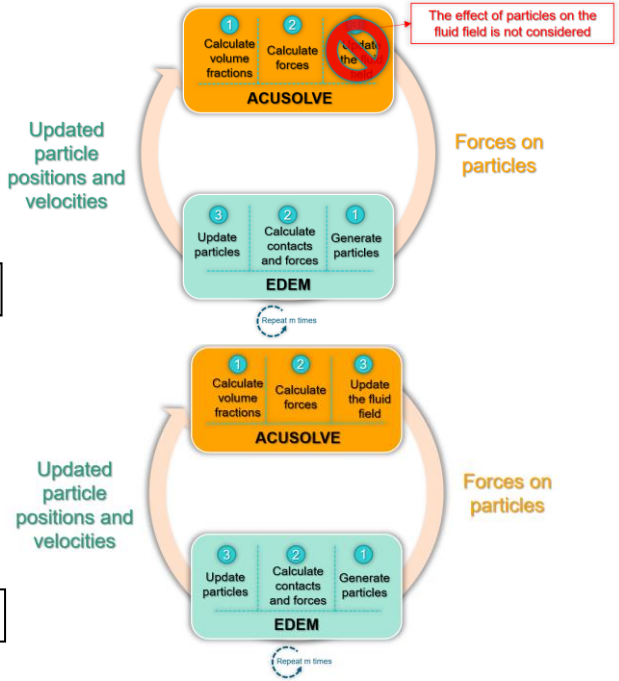
AcuSolve-EDEM連成機能

- 流体/粒子、粒子/粒子の相互作用を含む現象が解析可能
- 3種類の連成アプローチをサポート
  - 順次（Sequential、2020新機能）
  - 一方向連成（Uni-Directional、2020.1新機能）
  - 双方向連成（Bi-Directional、2021新機能）
- メッシュモーションを含む複合的な解析に対応

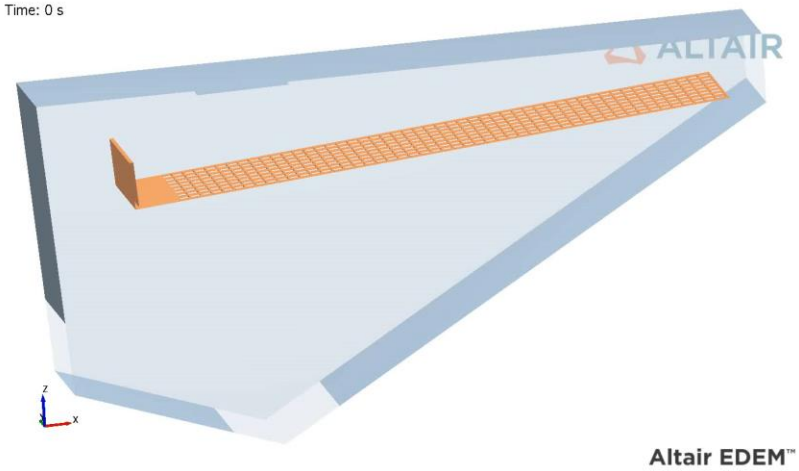


Sequential



Uni-Directional

Bi-Directional



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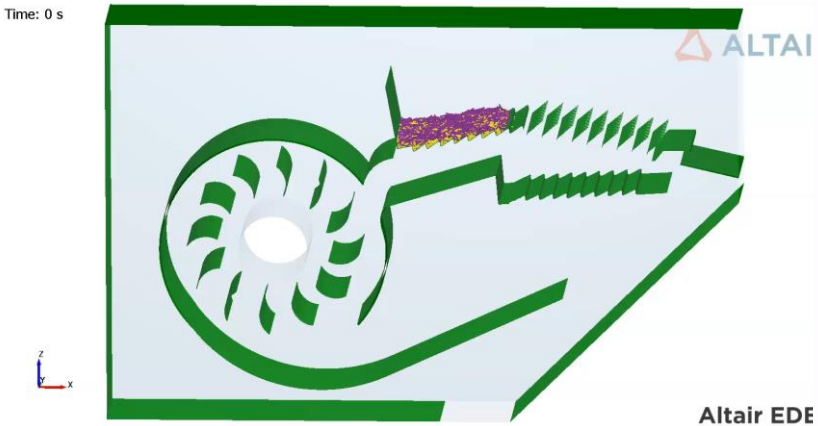
AcuSolve-EDEM連成機能強化

- 双方向連成（2021）
- 非球形粒子への対応（2021.1）
- 球形粒子に対するリフトモデル、トルクモデルの追加（2021.2）
- 抗力・揚力のスケーリング機能の追加（2021.2）
- 物質移動（水分含有量の蒸発）（2021.2）



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HYPERWORKS CFD

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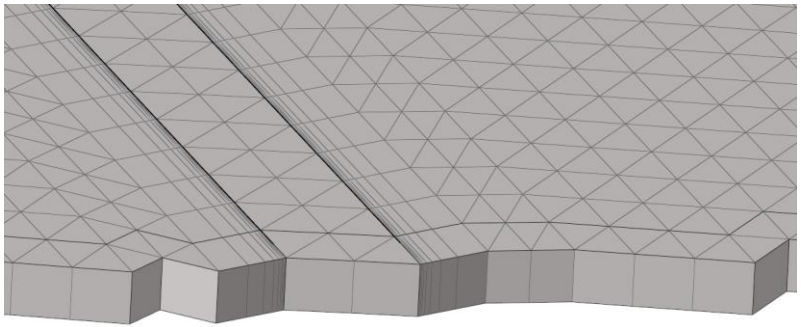
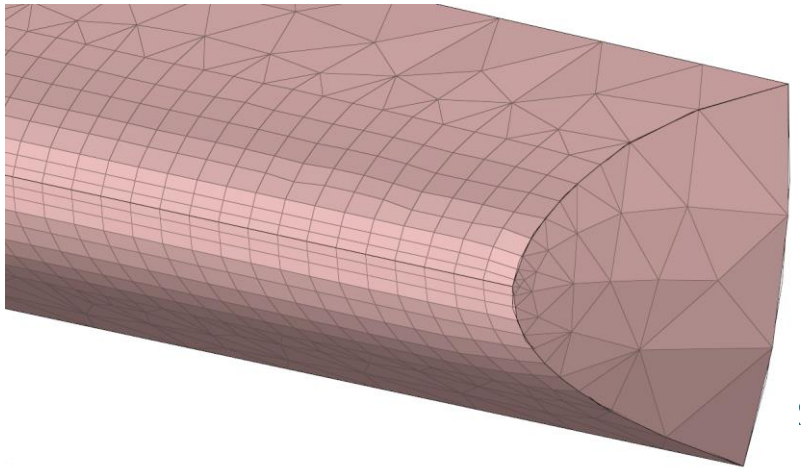
メッシュ作成機能強化

2021.2

- 押出しメッシュ（Mesh Extrusion）
  - 2次元解析時に有効な機能
  - CADデータに対応



- Edge Layers Mesh
  - ラインからサーフェスに層状のメッシュが作成可能
  - CADデータとFE geometryの両モデルに対応
  - Periodicメッシュや押出しメッシュに有効



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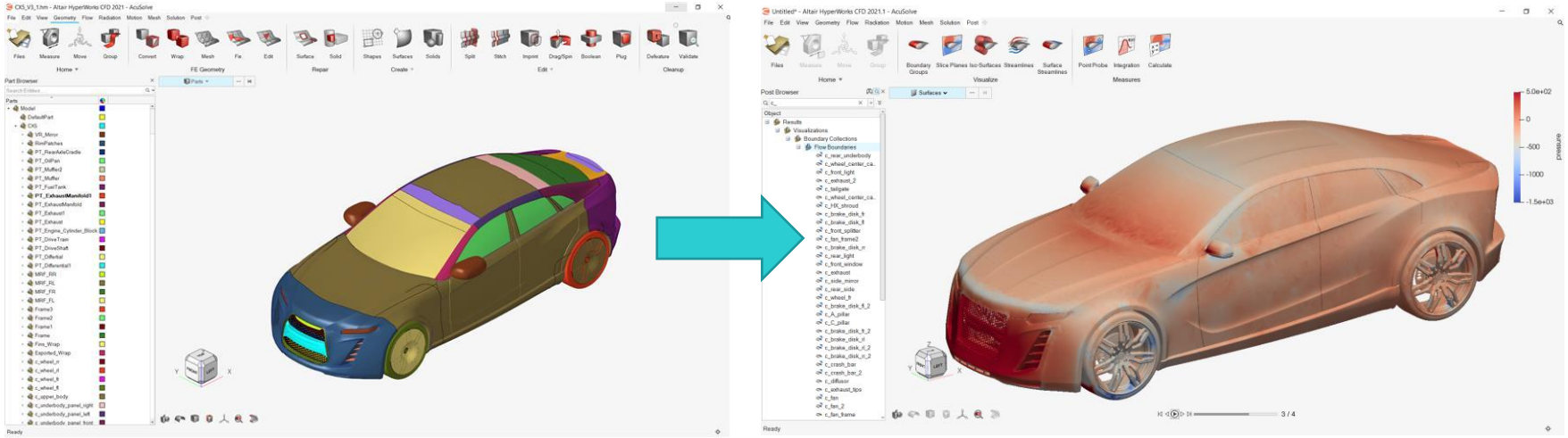
ポスト機能の正式リリース及び機能強化

- バージョン2021から正式リリース

1つのUIで設定➡解析➡ポスト処理まで完結



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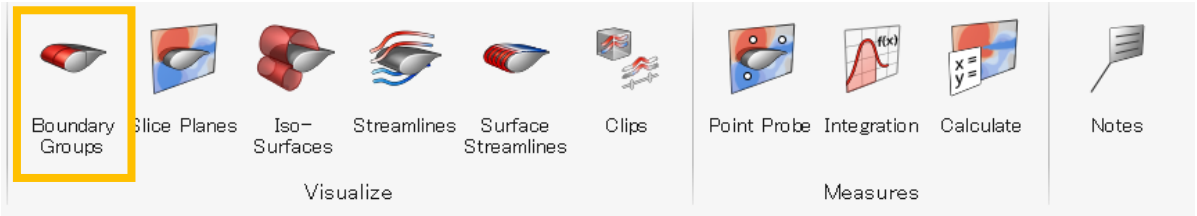
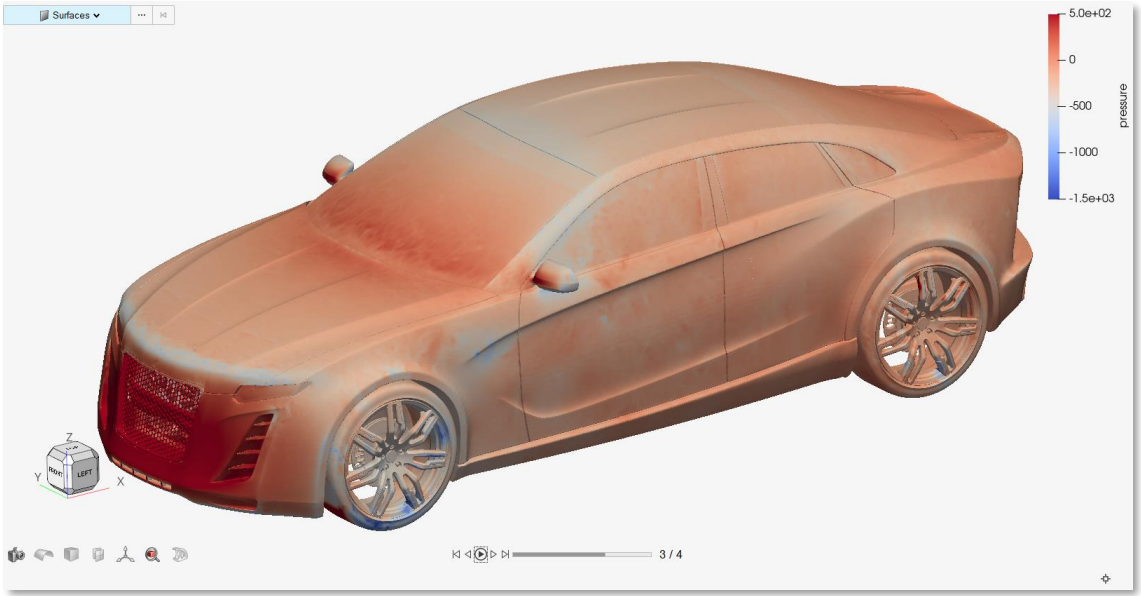
機能 1　Visualize：Boundary Group



- 境界面を表示する機能（コンター、ベクトル、アウトライン表示等が可能）



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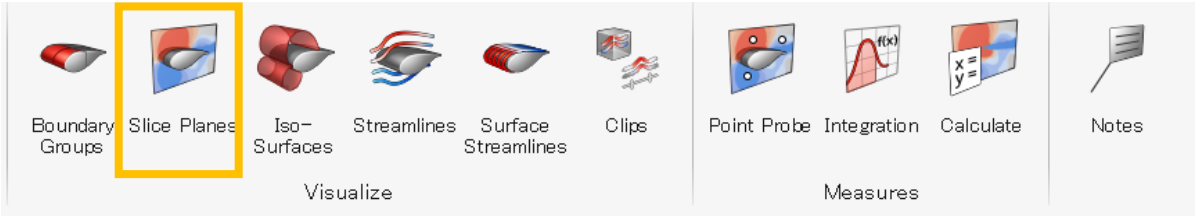
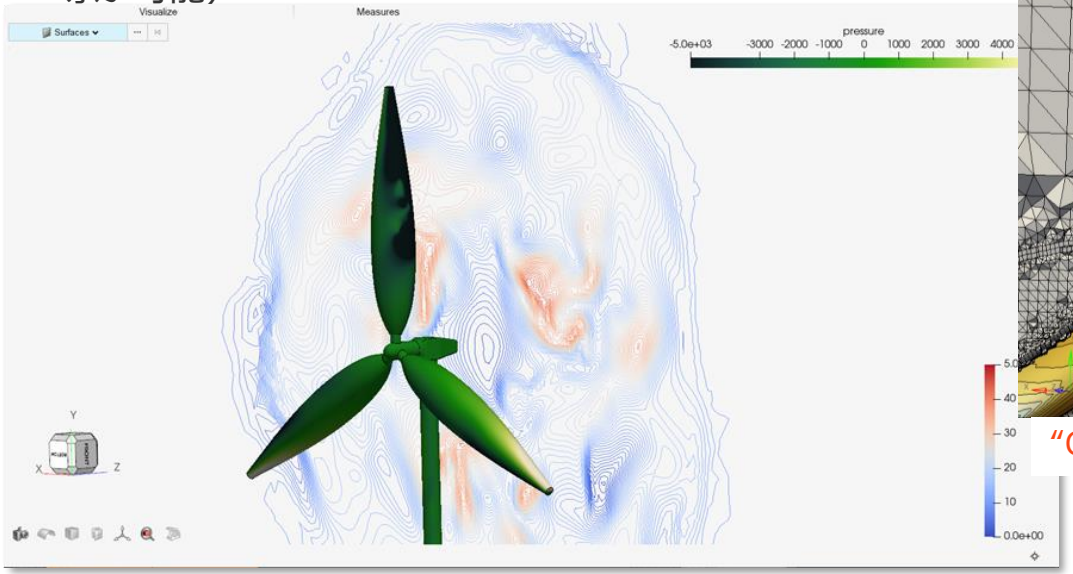
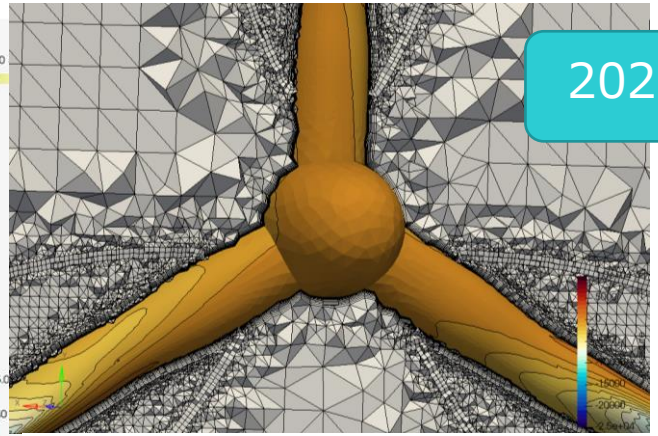
機能２　Visualize：Slice Planes



- X/Y/Zの各軸および任意位置での断面を表示する機能（コンター、ベクトル、アウトライン表示等が可能）





2021.1

“Crinkle” オプションで要素表示が可能

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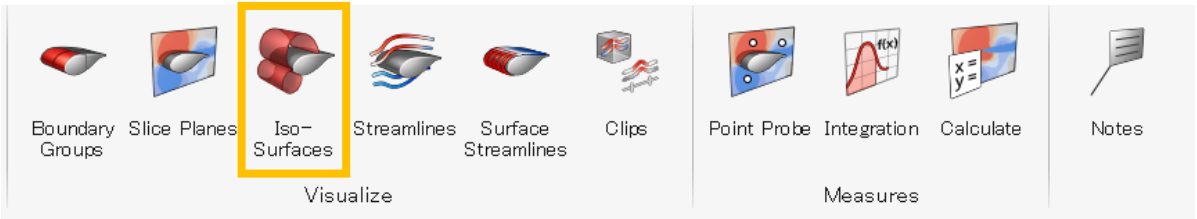
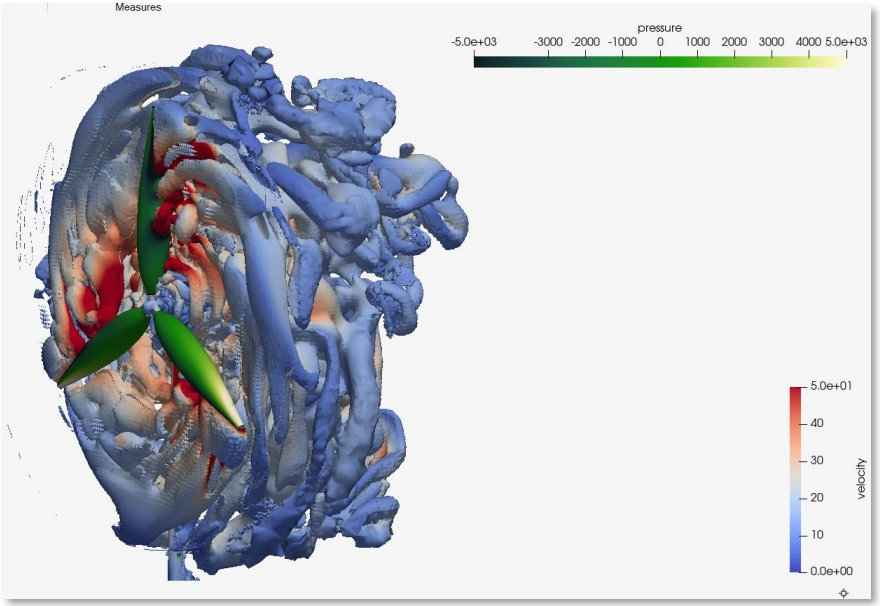
機能３　Visualize：Iso-Surfaces



- 等値面を表示する機能（コンター、ベクトル、アウトライン表示等が可能）



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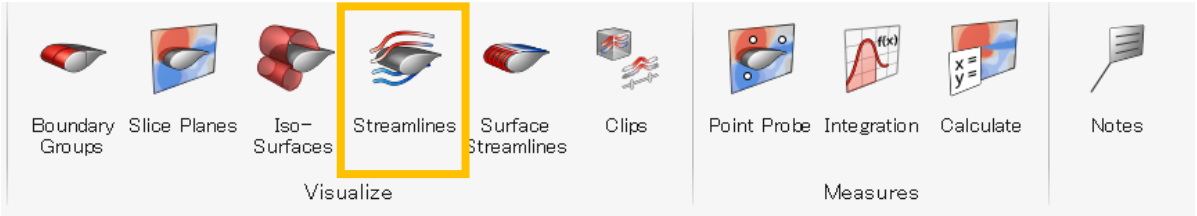
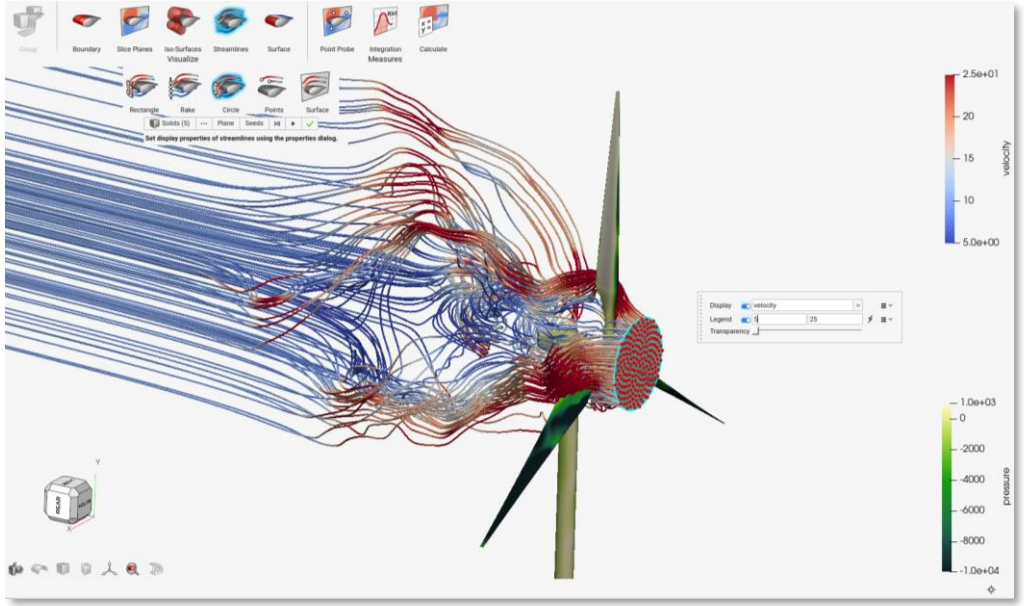
機能４　Visualize：Streamlines



- 流線を表示する機能



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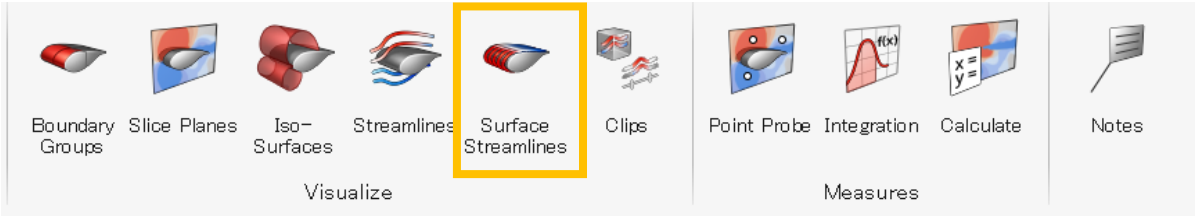
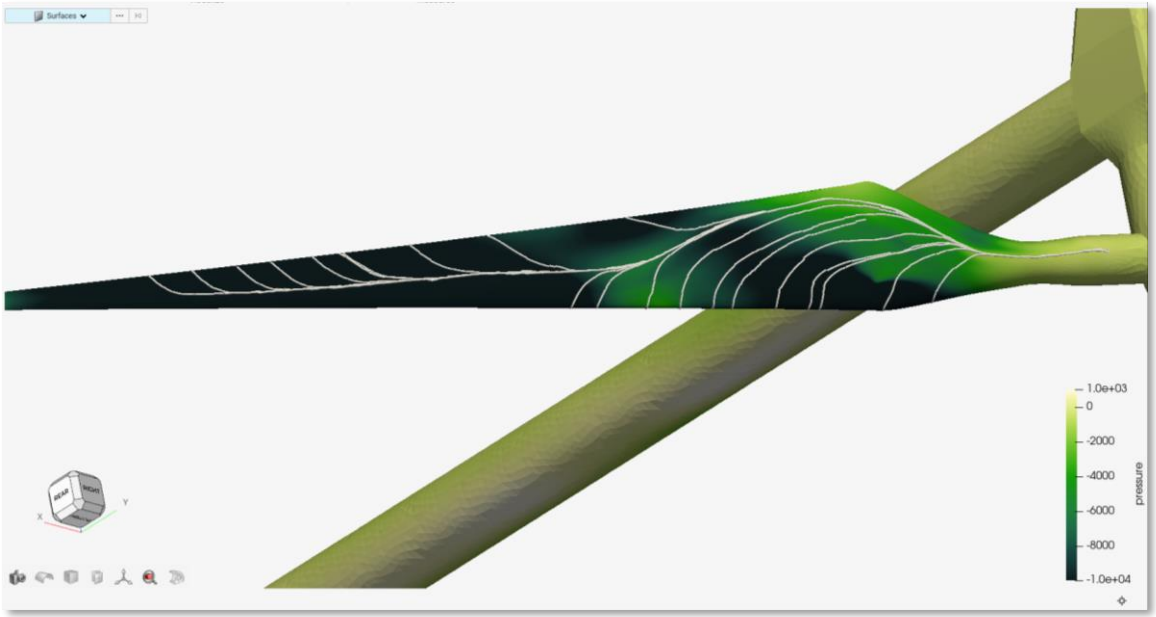
機能５　Visualize：Surface Streamlines



- 表面流線を表示する機能



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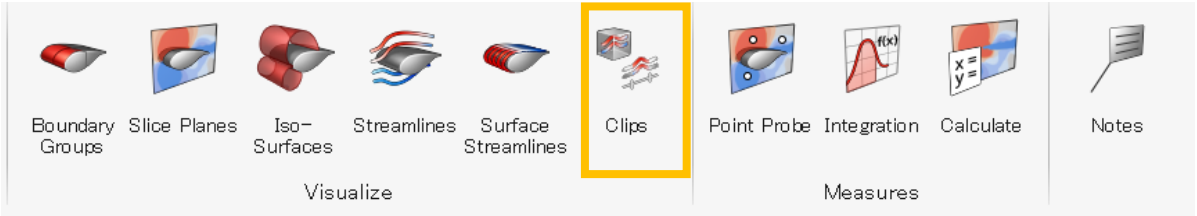
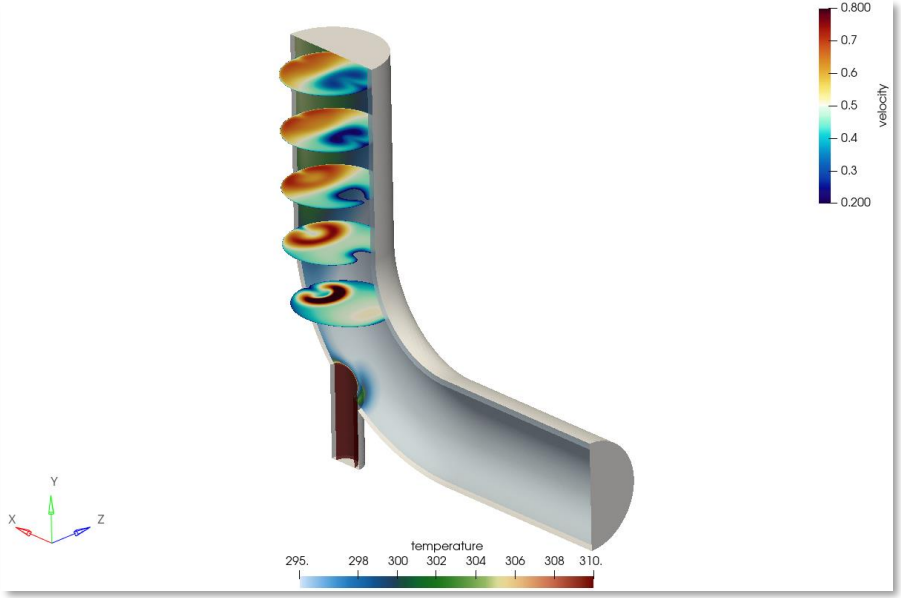
機能６　Visualize：Clip

2021.2



- 領域（Box）およびScalar値にて表示レンジをClipする機能



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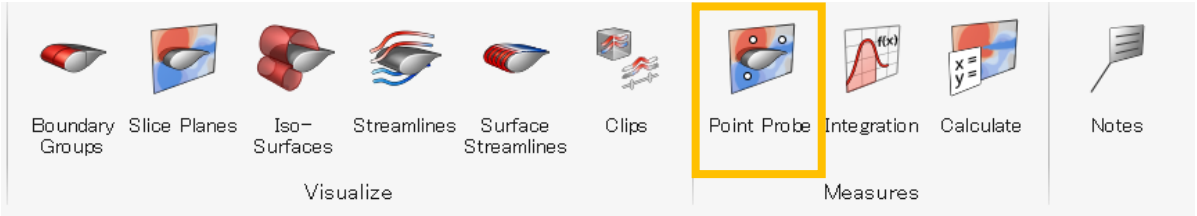
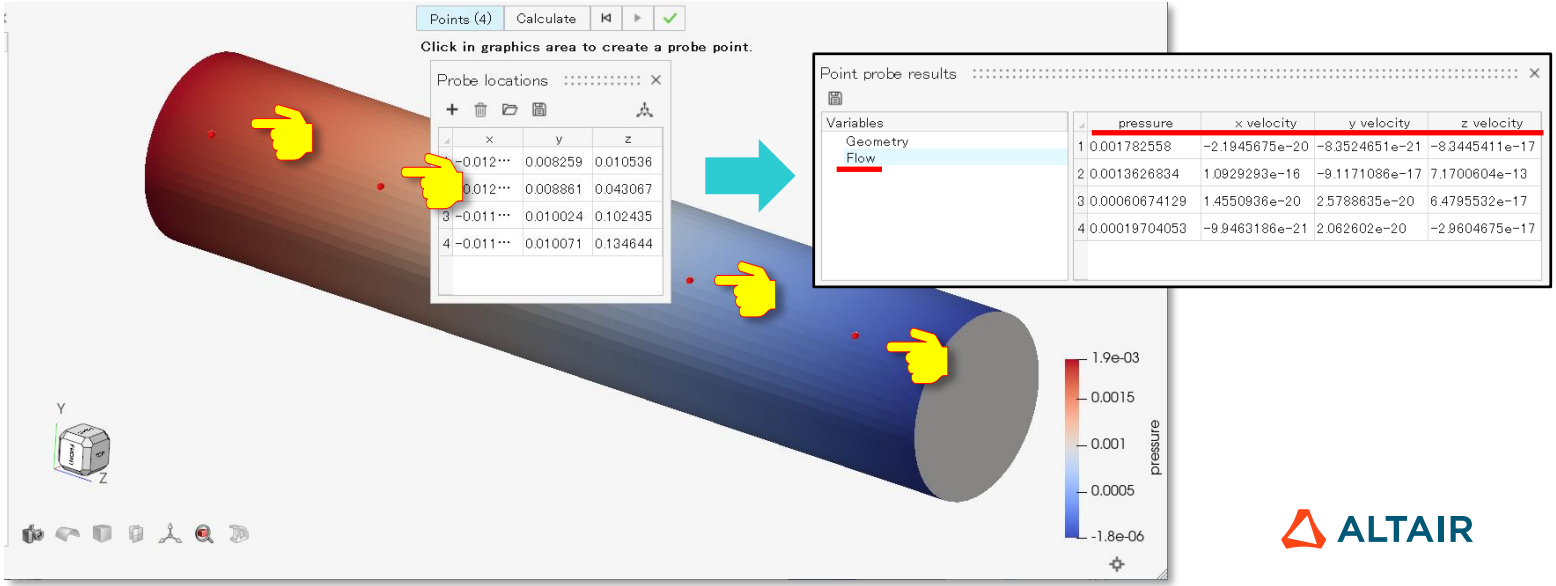
機能 7　Measures : Point Probe



- 指定した点のデータ（速度、圧力、温度等）を取得する機能



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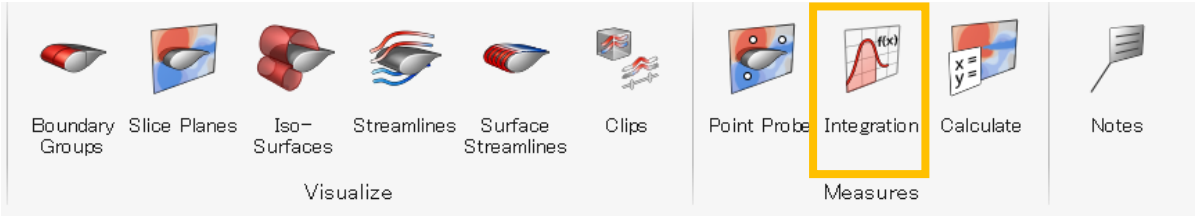
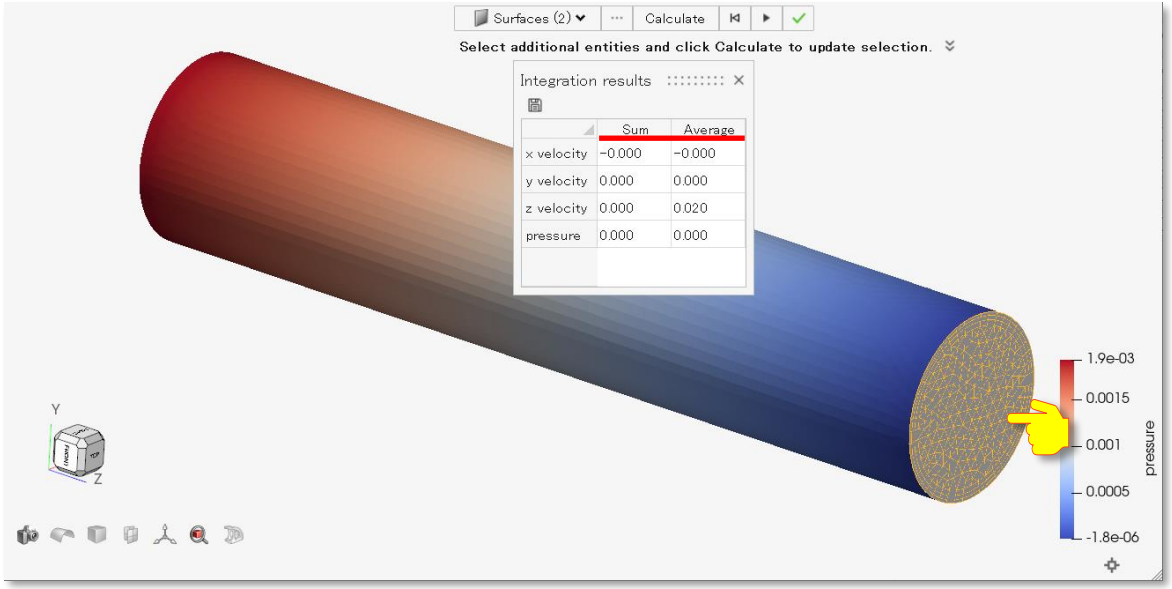
機能８　Measures : Integration



- 指定した面の演算データ（積分値、平均値）を取得する機能



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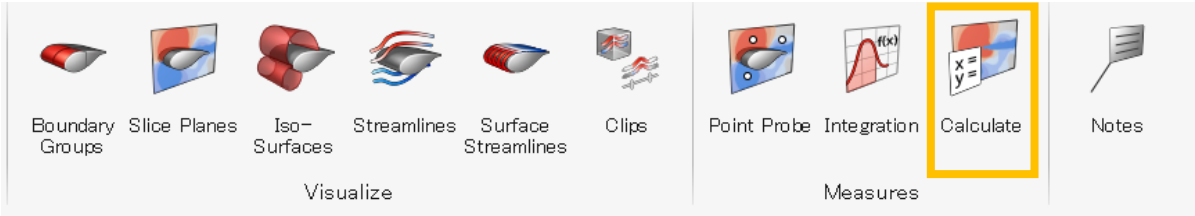
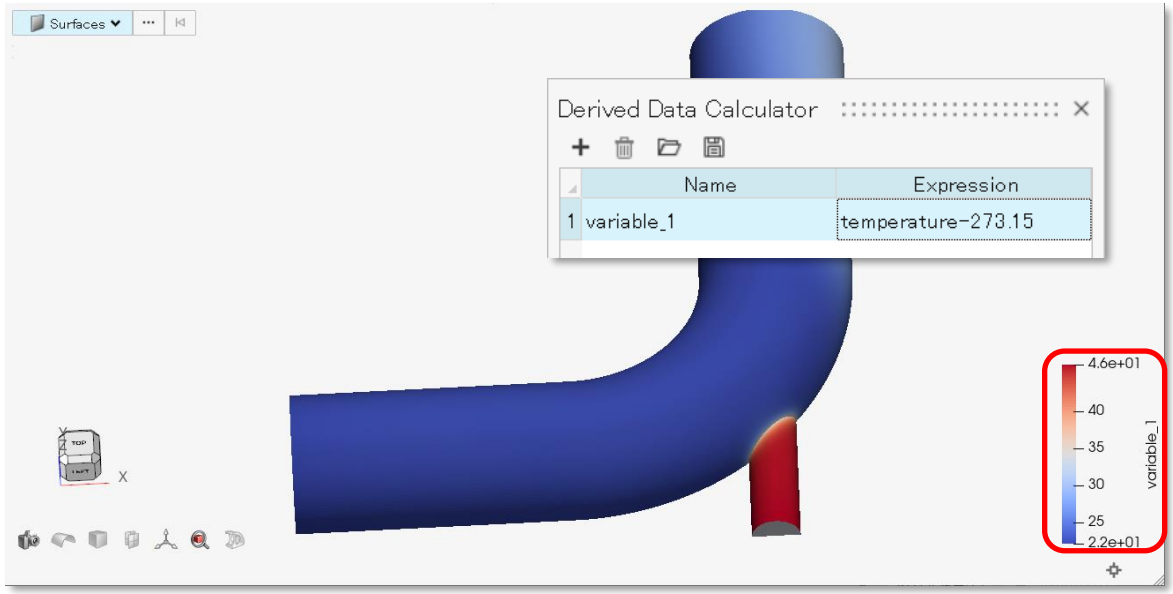
機能９　Measures : Calculate



- 評価変数（Variable）を作成する機能（表示単位変換や全圧といった新しい変数の表示が可能)



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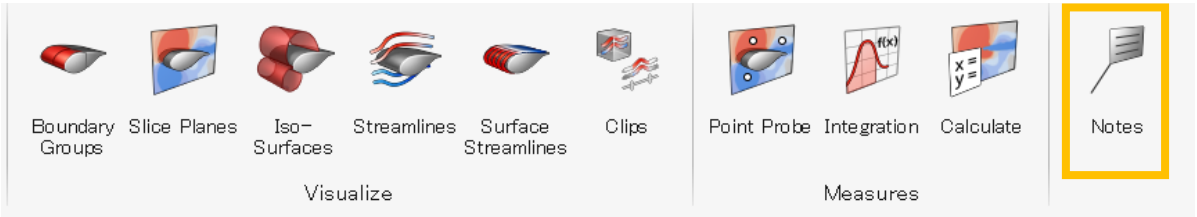
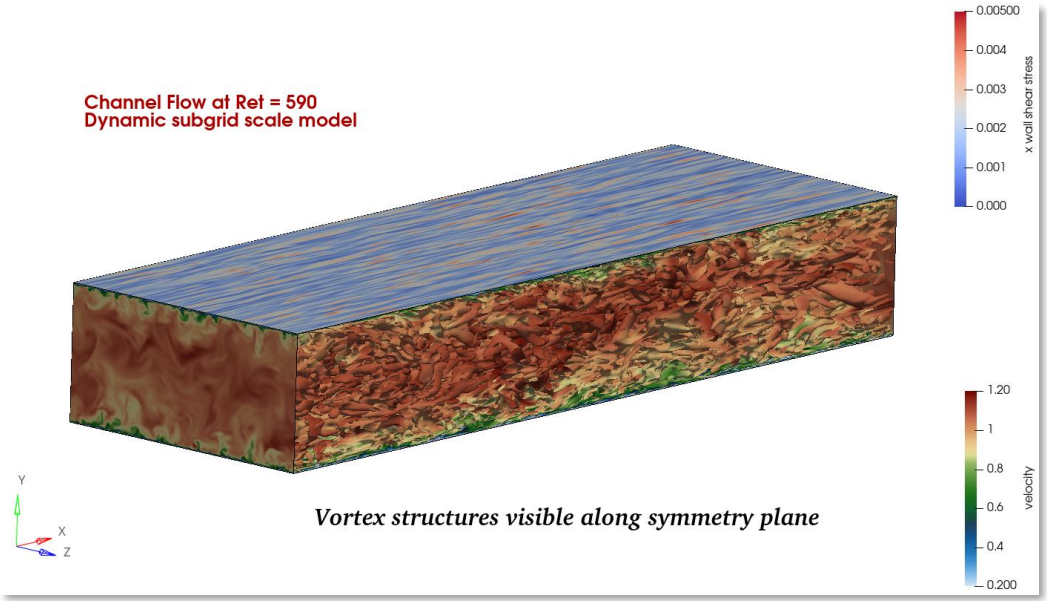
機能１０　Notes

2021.2



- コメントやモデル名を表示する機能



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SIMLAB (MULTIPHYSICS)

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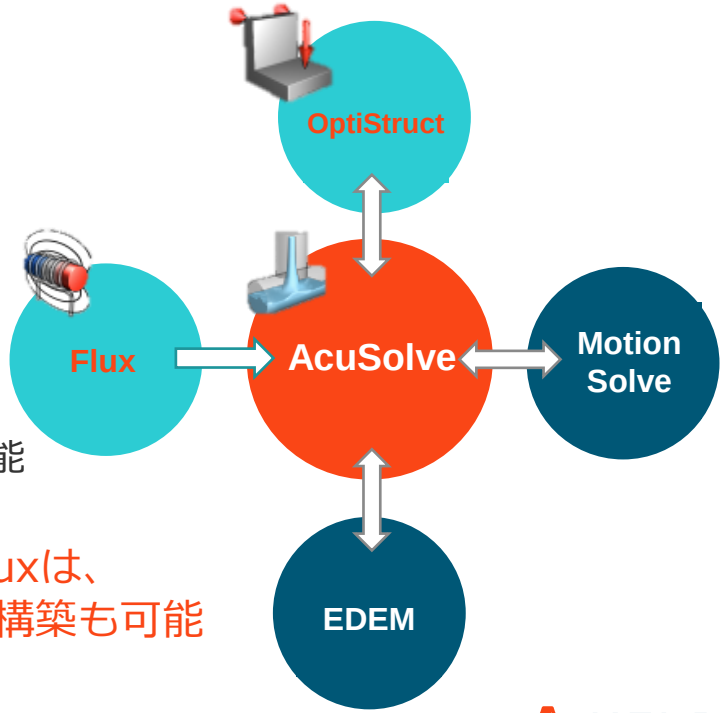
SimLab：Multiphysics simulationプラットフォーム

- 複数のソルバーと組み合わせたMultiphysics simulationのプラットフォーム
- AcuSolveと連成可能なソルバー
  - Flux
  - Optistruct 2021
  - MotionSolve 2021
  - EDEM 2021.2



- SimLabの特長
  - HyperWorks CFDと同等のAcuSolveのプリポスト機能
  - 日本語対応
  - トポロジー最適化 2021.2

OptistructとFluxは、
SimLab上でモデル構築も可能

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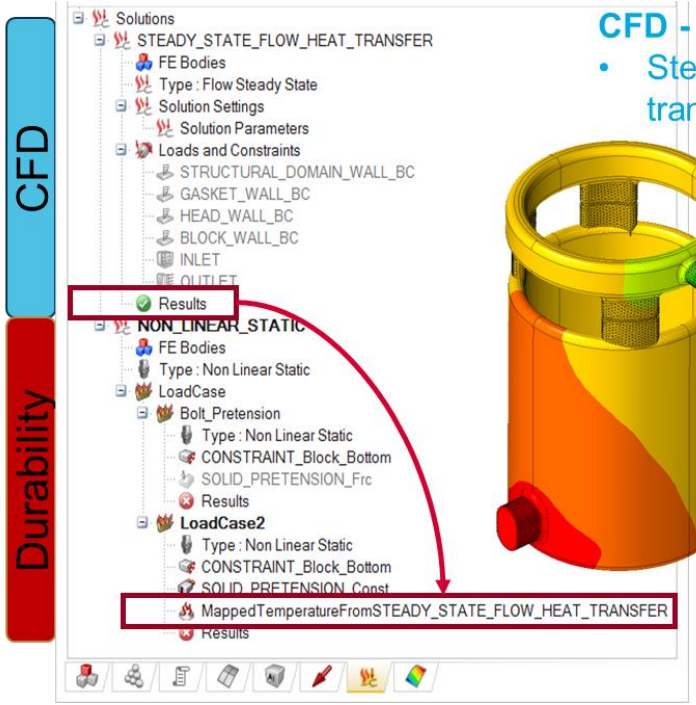
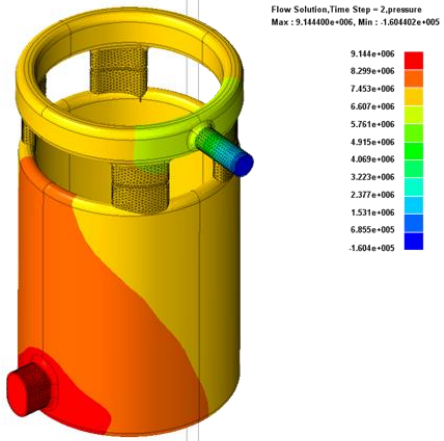
SimLab：Multiphysics機能（マッピング）

- AcuSolveの解析結果をOptistructの解析条件として、１つのUI上でマッピング可能



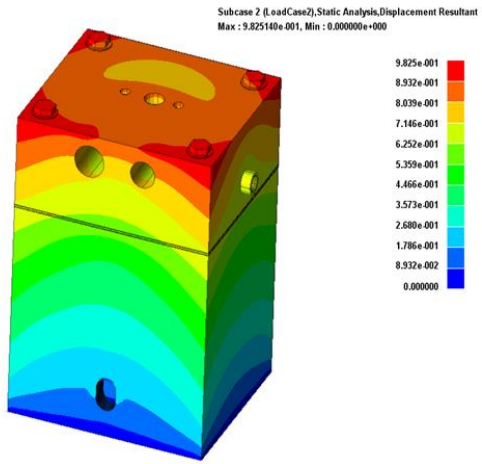
CFD - Laminar Flow

- Steady State Heat transfer



Structural

- Non Linear Static



１つのUIで、複数のソルバーに対応したモデル設定が可能

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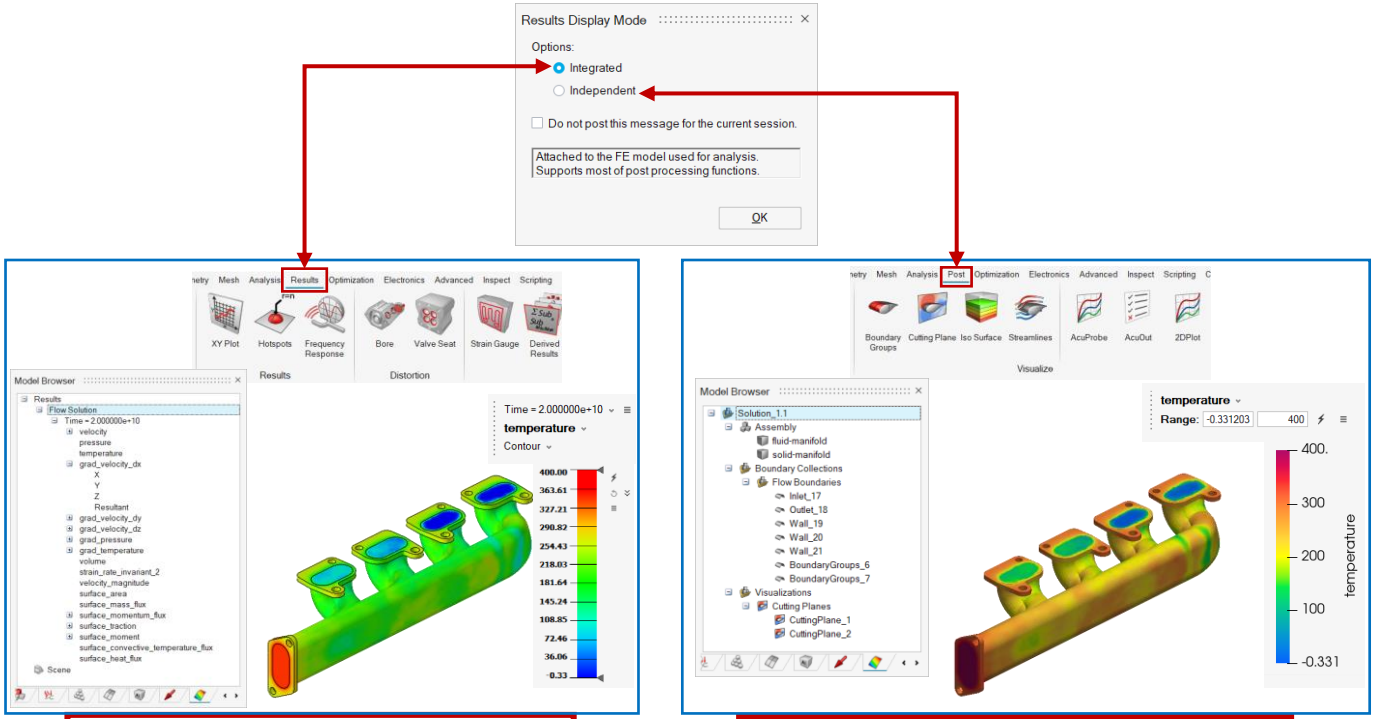
SimLab：Multiphysics機能（ポスト）

2021.2

- AcuSolveとOptistructの結果を連動/独立してポスト表示可能



Integrated Results Display Mode

Independent Results Display Mode

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