2-2. メッシュの作成

④全体メッシュの作成（snappyHexMeshの実施）

```
echo "snappyHexMesh 1CPU"
cp -r $CASE_DIR/$SNAPPYHEXMESH_DICT system/snappyHexMeshDict
$runApplication snappyHexMesh > log.snappyHexMesh
```

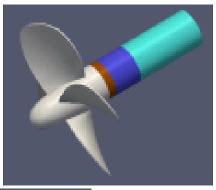
境界層の作成はなし

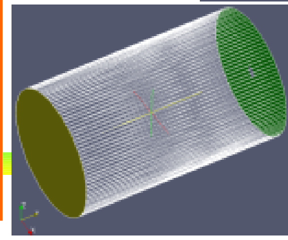
```
geometry
{
    innerCylinder_m.stl
    {
        type        triSurfaceMesh;
        name        innerCylinder;
    }

    innerCylinderSmall_m.stl
    {
        type        triSurfaceMesh;
        name        innerCylinderSmall;
    }

    outerCylinder_m.stl
    {
        type        triSurfaceMesh;
        name        outerCylinder;
    }

    inlet_m.stl
    {
        type        triSurfaceMesh;
        name        inlet;
    }

    outlet_m.stl
    {
        type        triSurfaceMesh;
        name        outlet;
    }
```

```
outerCylinder_temp
{
        type searchableCylinder;
        point1 (0 -0.8 0);
        point2 (0  0.2 0);
        radius 0.30;
}
```

outerCylinder部分のリファインするために設定

```
propellerTip_m.stl
{
    type        triSurfaceMesh;
    name        propellerTip;
}

propellerStem1_m.stl
{
    type        triSurfaceMesh;
    name        propellerStem1;
}

propellerStem2_m.stl
{
    type        triSurfaceMesh;
    name        propellerStem2;
}

propellerStem3_m.stl
{
    type        triSurfaceMesh;
    name        propellerStem3;
}
```



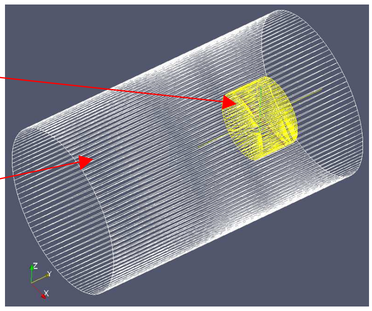


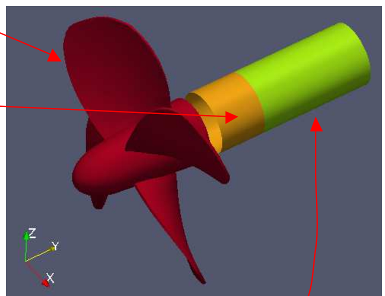
2-2. メッシュの作成

④全体メッシュの作成（snappyHexMeshの実施）（つづき）

feature edgeの設定

```
{
    file        "innerCylinderSmall_m.eMesh";
    level       4;
}

{
    file        "outerCylinder_m.eMesh";
    level       0;
}

{
    file        "propellerTip_m.eMesh";
    level       4;
}

{
    file        "propellerStem2_m.eMesh";
    level       4;
}

{
    file        "propellerStem3_m.eMesh";
    level       4;
}
```

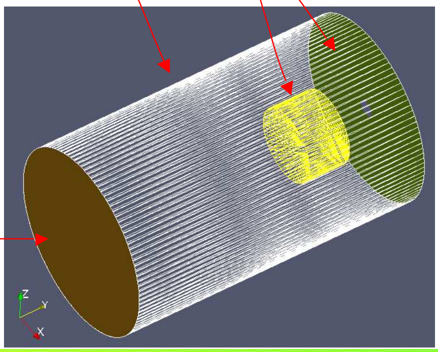




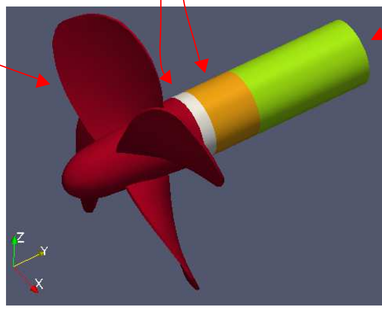
2-2. メッシュの作成
④全体メッシュの作成（snappyHexMeshの実施）（つづき）
refinementSurfacesの設定

```
innerCylinderSmall
{
    level       (4 4);
    cellZone    innerCylinderSmall;
    faceZone    innerCylinderSmall;
    cellZoneInside  inside;
}

outerCylinder
{
    level       (0 0);
}

inlet
{
    level       (0 0);
}

outlet
{
    level       (0 0);
}
```

回転させる領域



```
propellerTip
{
    level       (4 5);
}

propellerStem1
{
    level       (4 4);
}

propellerStem2
{
    level       (4 4);
}

propellerStem3
{
    level       (4 4);
}
```



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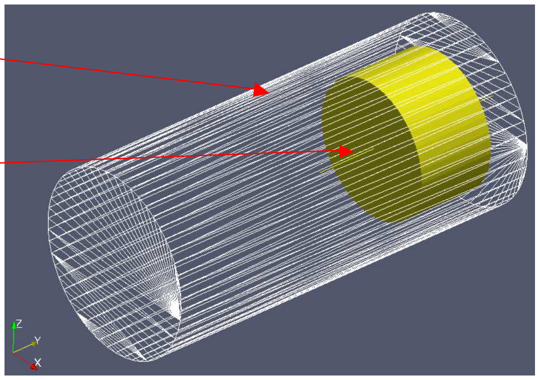
2-2. メッシュの作成
④全体メッシュの作成（snappyHexMeshの実施）（つづき）
refinementRegionsの設定

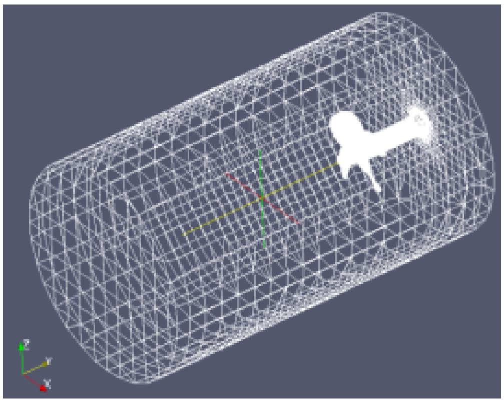
```
innerCylinder
{
    mode        inside;
    levels      ((1E15 3));
}

innerCylinderSmall
{
    mode        inside;
    levels      ((1E15 4));
}

outerCylinder_temp
{
    mode        inside;
    levels      ((1E15 0));
}
```

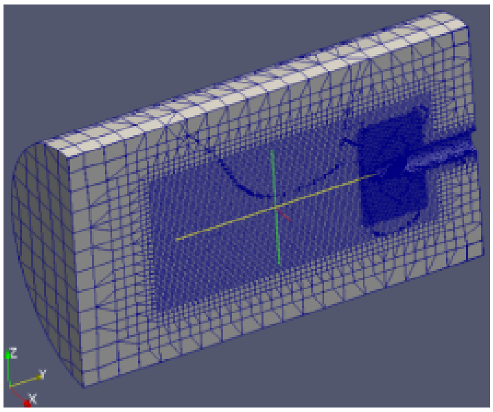


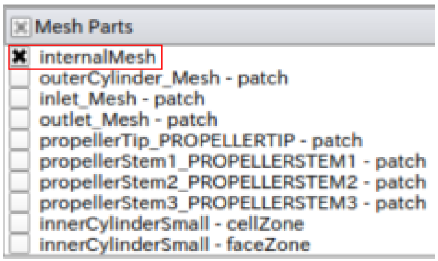
```
outerCylinder_temp
{
        type searchableCylinder;
        point1 (0 -0.8 0);
        point2 (0  0.2 0);
        radius 0.30;
}
```

2-2. メッシュの作成

④全体メッシュの作成(snappyHexMeshの実施)（つづき）

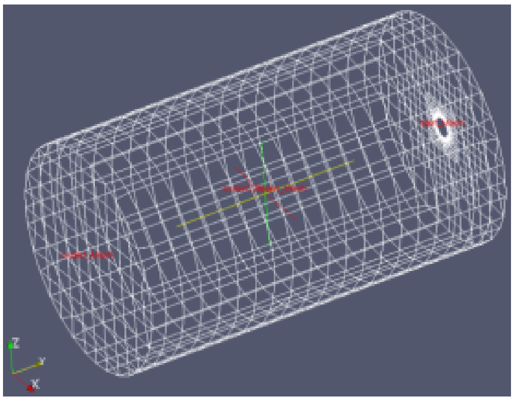


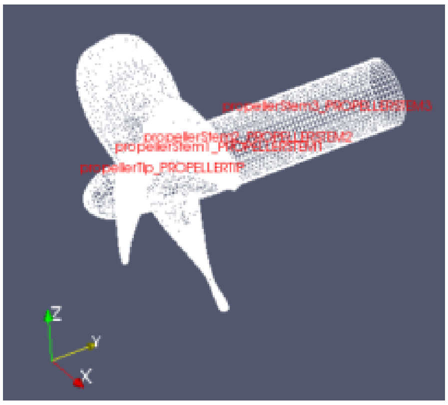


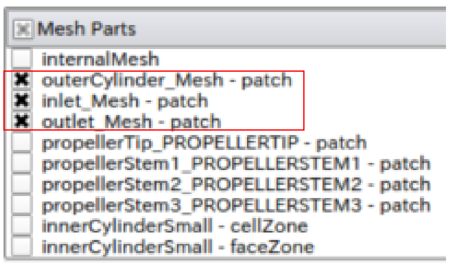


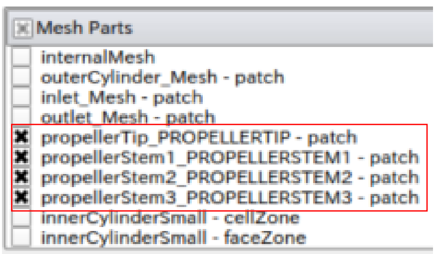
2-2. メッシュの作成

④全体メッシュの作成(snappyHexMeshの実施)（つづき）



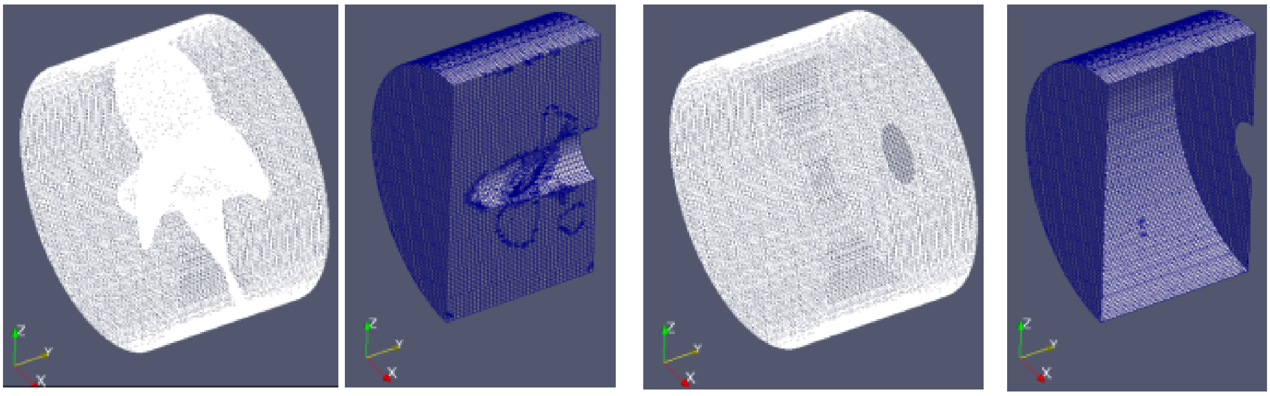


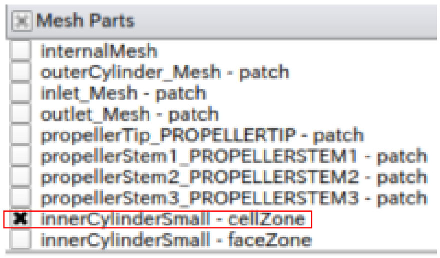


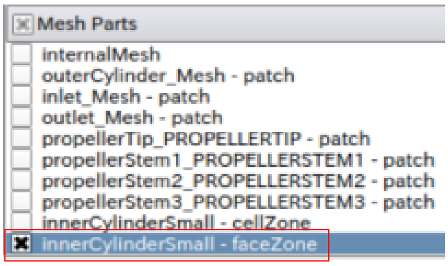


2-2. メッシュの作成

④全体メッシュの作成（snappyHexMeshの実施）（つづき）







2-2. メッシュの作成

⑤ダミーのfaceSetの作成（topoSetの実施）

```
echo "topoSet DummyfaceSet"
cp -r $CASE_DIR/$DummyfaceSet system/topoSetDict
$runApplication topoSet > log.dummyfaceset.topoSet
```

```
// Dummy faceSet for creating initial patches
{
    name    dummyFaces;
    type    faceSet;
    action  new;
    source  labelToFace;
    sourceInfo
    {
        value ();
    }
}
```

AMI用のパッチを作成するためのおまじない？
良く分かりませんが必要です。

2-2．メッシュの作成

⑥パッチの作成（createPatchの実施）

```
echo "createPatch"
cp -r $CASE_DIR/$CREATE_PatchDict system/createPatchDict
$runApplication createPatch
```

```
// Construct empty patches
{
    name AMI1;
    patchInfo
    {
        type            cyclicAMI;
        neighbourPatch  AMI2;
        transform       noOrdering;
        surface
        {}
    }
    constructFrom set;
    set dummyFaces;
}

{
    name AMI2;

    patchInfo
    {
        type            cyclicAMI;
        neighbourPatch  AMI1;
        transform       noOrdering;
        surface
        {}
    }
    constructFrom set;
    set dummyFaces;
}
```

Mesh Parts
- [x] internalMesh
- [ ] outerCylinder_Mesh - patch
- [ ] inlet_Mesh - patch
- [ ] outlet_Mesh - patch
- [ ] propellerTip_PROPELLERTIP - patch
- [ ] propellerStem1_PROPELLERSTEM1 - patch
- [ ] propellerStem2_PROPELLERSTEM2 - patch
- [ ] propellerStem3_PROPELLERSTEM3 - patch
- [ ] innerCylinderSmall - cellZone
- [ ] innerCylinderSmall - faceZone

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2-2．メッシュの作成

⑦回転面の設定（createBafflesの実施）

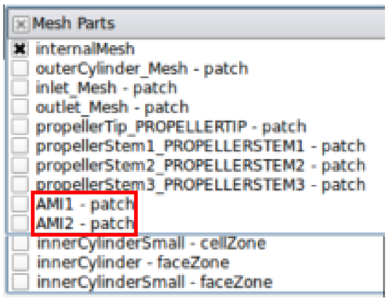
```
echo "createBaffles"
$runApplication createBaffles -internalFacesOnly $AMI_AREA '(AMI1 AMI2)' > log.createBaffles
```

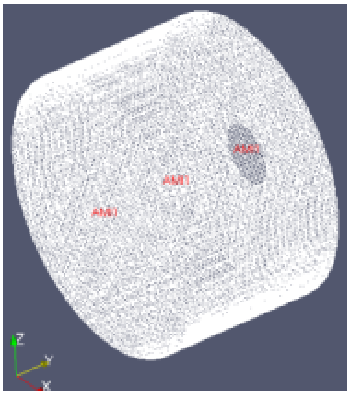
```
Usage: createBaffles [OPTIONS] <faceZone> <(masterPatch slavePatch)>
options:
  -additionalPatches <((master2 slave2) .. (masterN slaveN))>
  -case <dir>        specify alternate case directory, default is the cwd
  -internalFacesOnly
                     do not convert boundary faces
  -noFunctionObjects
                     do not execute functionObjects
  -overwrite         overwrite existing mesh/results files
  -parallel          run in parallel
  -region <name>     specify alternative mesh region
  -roots <(dir1 .. dirN)>
                     slave root directories for distributed running
  -updateFields      update fields to include new patches: NOTE: updated field
                     values may need to be edited
  -srcDoc            display source code in browser
  -doc               display application documentation in browser
  -help              print the usage

Makes internal faces into boundary faces.
Does not duplicate points, unlike mergeOrSplitBaffles.
```

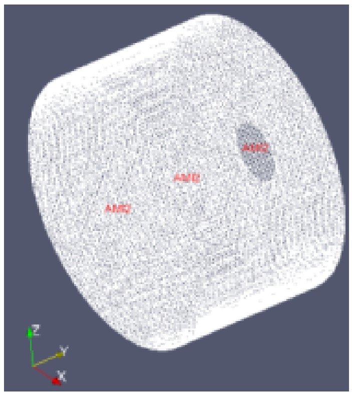
faceSetでは設定できない

2-2. メッシュの作成

⑦回転面の設定（createBafflesの実施）（つづき）

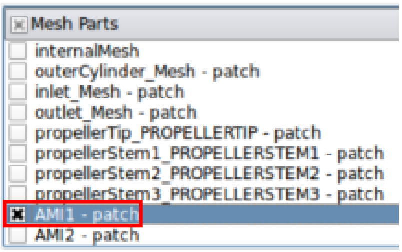


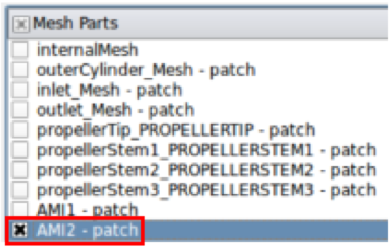




⑥で設定したAMI1, AMI2が作成される

形状としては innerCylinderSmall と同じ

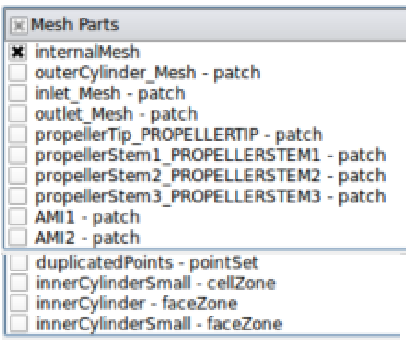




2-2. メッシュの作成

⑧回転面の分割（mergeOrSplitBafflesの実施）

```
echo "mergeOrSplitBaffles"
$runApplication mergeOrSplitBaffles -split
```



先に作ったAMI1, AMI2を分離する

2-2. メッシュの作成

⑨boundaryの調整

```
9
(
    outerCylinder_Mesh
    {
        type            wall;
        nFaces          976;
        startFace       1709520;
    }
    inlet_Mesh
    {
        type            patch;
        nFaces          676;
        startFace       1710496;
    }
    outlet_Mesh
    {
        type            patch;
        nFaces          112;
        startFace       1711172;
    }
    propellerTip_PROPELLERTIP
    {
        type            wall;
        nFaces          21650;
        startFace       1711284;
    }
    propellerStem1_PROPELLERSTEM1
    {
        type            wall;
        nFaces          188;
        startFace       1732934;
    }
    propellerStem2_PROPELLERSTEM2
    {
        type            wall;
        nFaces          576;
        startFace       1733122;
    }
    propellerStem3_PROPELLERSTEM3
    {
        type            wall;
        nFaces          1536;
        startFace       1733698;
    }
    AMI1
    {
        type            cyclicAMI;
        nFaces          22416;
        startFace       1735234;
        matchTolerance  0.0001;
        neighbourPatch  AMI2;
        transform       noOrdering;
    }
    AMI2
    {
        type            cyclicAMI;
        nFaces          22416;
        startFace       1757650;
        matchTolerance  0.0001;
        neighbourPatch  AMI1;
        transform       noOrdering;
    }
```

wallをpatchに変更する

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2-2. メッシュの作成　checkMesh

```
Checking geometry...
    Overall domain bounding box (-0.300104 -0.800006 -0.300104) (0.300104 0.200007 0.300101)
    Mesh (non-empty, non-wedge) directions (1 1 1)
    Mesh (non-empty) directions (1 1 1)
    Boundary openness (-1.9461e-17 1.3707e-16 3.2876e-17) OK.
    Max cell openness = 3.5398e-16 OK.
    Max aspect ratio = 5.14867 OK.
    Minimum face area = 2.1276e-07. Maximum face area = 0.00393196.  Face area magnitudes OK.
    Min volume = 6.85713e-10. Max volume = 0.000172783.  Total volume = 0.279817.  Cell volumes OK.
    Mesh non-orthogonality Max: 64.5788 average: 7.58616
    Non-orthogonality check OK.
    Face pyramids OK.
    Max skewness = 3.96661 OK.
    Coupled point location match (average 0) OK.

Mesh OK.
```

本方法

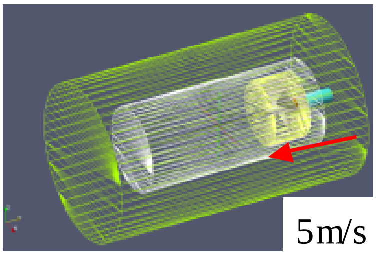
```
Checking geometry...
    Overall domain bounding box (-0.300087 -0.800006 -0.299537) (0.300087 0.200007 0.299534)
    Mesh (non-empty, non-wedge) directions (1 1 1)
    Mesh (non-empty) directions (1 1 1)
    Boundary openness (-5.63903e-17 -6.63464e-17 4.85134e-17) OK.
    Max cell openness = 4.1211e-16 OK.
    Max aspect ratio = 5.14912 OK.
    Minimum face area = 2.12732e-07. Maximum face area = 0.00388964.  Face area magnitudes OK.
    Min volume = 6.85734e-10. Max volume = 0.000175307.  Total volume = 0.279518.  Cell volumes OK.
    Mesh non-orthogonality Max: 65.0193 average: 8.7203
    Non-orthogonality check OK.
    Face pyramids OK.
    Max skewness = 3.98181 OK.
    Coupled point location match (average 0) OK.

Mesh OK.
```

チュートリアル

2-3. 計算の設定

乱流モデル（kEpsilon），初期設定値等はチュートリアルと同じ

●Uの設定

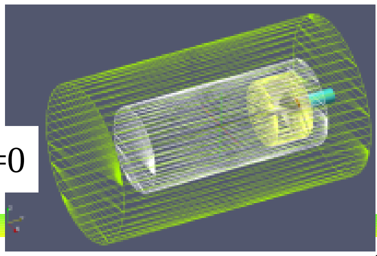



```
dimensions      [0 1 -1 0 0 0 0];

internalField   uniform (0 0 0);

boundaryField
{
    inlet_Mesh
    {
        type            fixedValue;
        value           uniform (0 -5 0);
    }

    outlet_Mesh
    {
        type            inletOutlet;
        inletValue      uniform (0 0 0);
        value           uniform (0 0 0);
    }

    outerCylinder_Mesh
    {
        type            fixedValue;
        value           uniform (0 0 0);
    }

    propellerTip_PROPELLERTIP
    {
        type            movingWallVelocity;
        value           uniform (0 0 0);
    }

    propellerStem1_PROPELLERSTEM1
    {
        type            movingWallVelocity;
        value           uniform (0 0 0);
    }

propellerStem2_PROPELLERSTEM2
{
    type            movingWallVelocity;
    value           uniform (0 0 0);
}

propellerStem3_PROPELLERSTEM3
{
    type            movingWallVelocity;
    value           uniform (0 0 0);
}

AMI1
{
    type            cyclicAMI;
    value           uniform (0 0 0);
}

AMI2
{
    type            cyclicAMI;
    value           uniform (0 0 0);
}
```


2-3. 計算の設定 （つづき）

●pの設定

```
dimensions      [0 2 -2 0 0 0 0];

internalField   uniform 0;

boundaryField
{
    inlet_Mesh
    {
        type            zeroGradient;
    }

    outlet_Mesh
    {
        type            fixedValue;
        value           uniform 0;
    }

    outerCylinder_Mesh
    {
        type            zeroGradient;
    }

    propellerTip_PROPELLERTIP
    {
        type            zeroGradient;
    }

    propellerStem1_PROPELLERSTEM1
    {
        type            zeroGradient;
    }

propellerStem2_PROPELLERSTEM2
{
    type            zeroGradient;
}

propellerStem3_PROPELLERSTEM3
{
    type            zeroGradient;
}

AMI1
{
    type            cyclicAMI;
    value           uniform 0;
}

AMI2
{
    type            cyclicAMI;
    value           uniform 0;
}
```



2-3. 計算の設定 （つづき）

●kの設定

```
dimensions      [0 2 -2 0 0 0 0];

internalField   uniform 0.06;

boundaryField
{
    inlet_Mesh
    {
        type            fixedValue;
        value           $internalField;
    }

    outlet_Mesh
    {
        type            inletOutlet;
        inletValue      $internalField;
        value           $internalField;
    }

    outerCylinder_Mesh
    {
        type            kqRWallFunction;
        value           $internalField;
    }

    propellerTip_PROPELLERTIP
    {
        type            kqRWallFunction;
        value           $internalField;
    }

    propellerStem1_PROPELLERSTEM1
    {
        type            kqRWallFunction;
        value           $internalField;
    }

    propellerStem2_PROPELLERSTEM2
    {
        type            kqRWallFunction;
        value           $internalField;
    }

    propellerStem3_PROPELLERSTEM3
    {
        type            kqRWallFunction;
        value           $internalField;
    }

    AMI1
    {
        type            cyclicAMI;
        value           $internalField;
    }

    AMI2
    {
        type            cyclicAMI;
        value           $internalField;
    }
}
```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2-3. 計算の設定 （つづき）

●epsilonの設定

```
dimensions      [0 2 -3 0 0 0 0];

internalField   uniform 0.0495;

boundaryField
{
    inlet_Mesh
    {
        type            fixedValue;
        value           $internalField;
    }

    outlet_Mesh
    {
        type            inletOutlet;
        inletValue      $internalField;
        value           $internalField;
    }

    outerCylinder_Mesh
    {
        type            epsilonWallFunction;
        value           $internalField;
    }

    propellerTip_PROPELLERTIP
    {
        type            epsilonWallFunction;
        value           $internalField;
    }

    propellerStem1_PROPELLERSTEM1
    {
        type            epsilonWallFunction;
        value           $internalField;
    }

    propellerStem2_PROPELLERSTEM2
    {
        type            epsilonWallFunction;
        value           $internalField;
    }

    propellerStem3_PROPELLERSTEM3
    {
        type            epsilonWallFunction;
        value           $internalField;
    }

    AMI1
    {
        type            cyclicAMI;
        value           $internalField;
    }

    AMI2
    {
        type            cyclicAMI;
        value           $internalField;
    }
}
```

2-3. 計算の設定 （つづき）

●nutの設定

```
dimensions      [0 2 -1 0 0 0 0];

internalField   uniform 0;

boundaryField
{
    inlet_Mesh
    {
        type            calculated;
        value           uniform 0;
    }

    outlet_Mesh
    {
        type            calculated;
        value           uniform 0;
    }

    outerCylinder_Mesh
    {
        type            nutkWallFunction;
        value           uniform 0;
    }

    propellerTip_PROPELLERTIP
    {
        type            nutkWallFunction;
        value           uniform 0;
    }

    propellerStem1_PROPELLERSTEM1
    {
        type            nutkWallFunction;
        value           uniform 0;
    }

    propellerStem2_PROPELLERSTEM2
    {
        type            nutkWallFunction;
        value           uniform 0;
    }

    propellerStem3_PROPELLERSTEM3
    {
        type            nutkWallFunction;
        value           uniform 0;
    }

    AMI1
    {
        type            cyclicAMI;
        value           uniform 0;
    }

    AMI2
    {
        type            cyclicAMI;
        value           uniform 0;
    }
}
```


2-3. 計算の設定 （つづき）

●fvSolutionの設定

```
solvers
{
    pcorr
    {
        solver          GAMG;
        tolerance       1e-2;
        relTol          0;
        smoother        DICGaussSeidel;
        cacheAgglomeration no;
        nCellsInCoarsestLevel 10;
        agglomerator    faceAreaPair;
        mergeLevels     1;
        maxIter         50;
    }

    p
    {
        $pcorr;
        tolerance       1e-5;
        relTol          0.01;
    }

    pFinal
    {
        $p;
        tolerance       1e-6;
        relTol          0;
    }

    "(U|k|epsion|omega)"
    {
        solver          smoothSolver;
        smoother        GaussSeidel;
        tolerance       1e-6;
        relTol          0.1;
    }

    "(U|k|epsilon|omega)Final"
    {
        solver          PBiCG;
        preconditioner  DILU;
        tolerance       1e-6;
        relTol          0;
    }
}

PIMPLE
{
    correctPhi          no;
    nOuterCorrectors    3;
    nCorrectors         1;
    nNonOrthogonalCorrectors 0;
}

relaxationFactors
{
    "(U|k|epsilon|omega).*"   1;
}

cache
{
    grad(U);
}
```

2-3. 計算の設定 （つづき）

●fvSchemesの設定

```
ddtSchemes
{
    default         Euler;
}

gradSchemes
{
    default         Gauss linear;
    grad(p)         Gauss linear;
    grad(U)         cellLimited Gauss linear 1;
}

divSchemes
{
    default         none;
//    div(phi,U)      Gauss upwind;
    div(phi,U)      Gauss linearUpwind grad(U);
    div(phi,k)      Gauss upwind;
    div(phi,epsilon) Gauss upwind;
    div(phi,omega)  Gauss upwind;
    div((nuEff*dev(T(grad(U))))) Gauss linear;
}

laplacianSchemes
{
    default         Gauss linear limited 0.33;
}
```

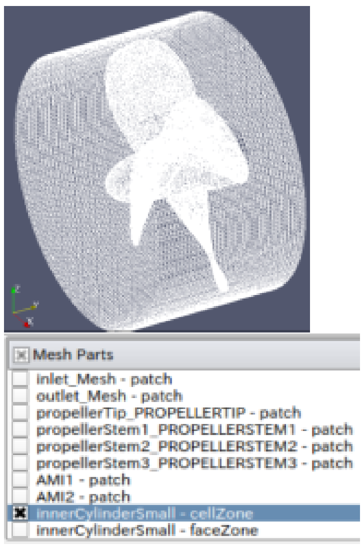
```
interpolationSchemes
{
    default         linear;
}

snGradSchemes
{
    default         limited 0.33;
}

fluxRequired
{
    default         no;
    pcorr           ;
    p               ;
}
```


2-3. 計算の設定 （つづき）

●dynamicMeshDictの設定

```
dynamicFvMesh   solidBodyMotionFvMesh;

motionSolverLibs ( "libfvMotionSolvers.so" );

solidBodyMotionFvMeshCoeffs
{
    cellZone        innerCylinderSmall;

    solidBodyMotionFunction  rotatingMotion;
    rotatingMotionCoeffs
    {
        CofG        (0 0 0);
        radialVelocity (0 9000 0); // deg/s
    }
}
```

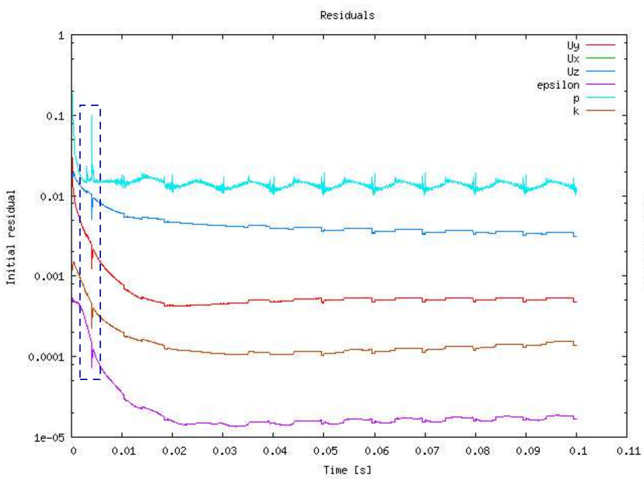
→ 150rpm



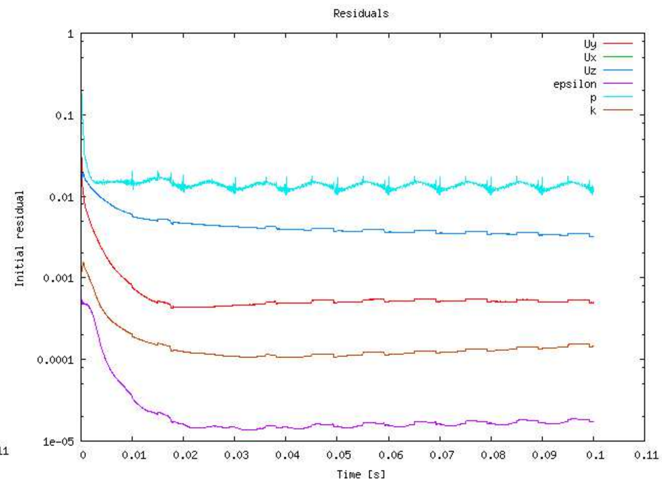
2-4. 計算の結果

チュートリアルとの比較（収束状況）

ほぼ同じ結果になっている事が分かる。



本方法

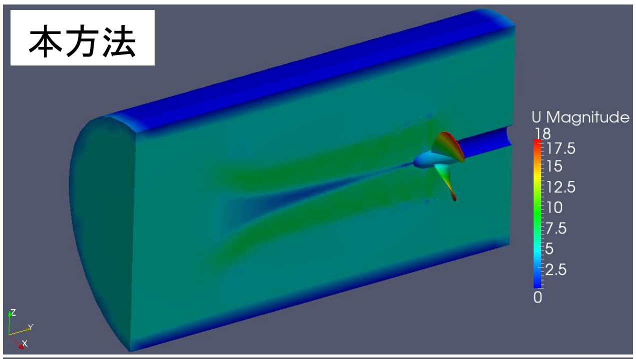


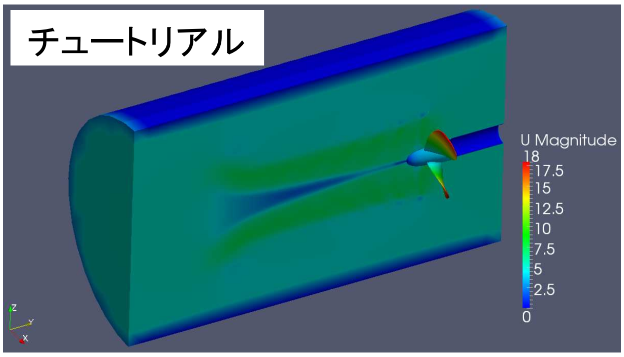
チュートリアル

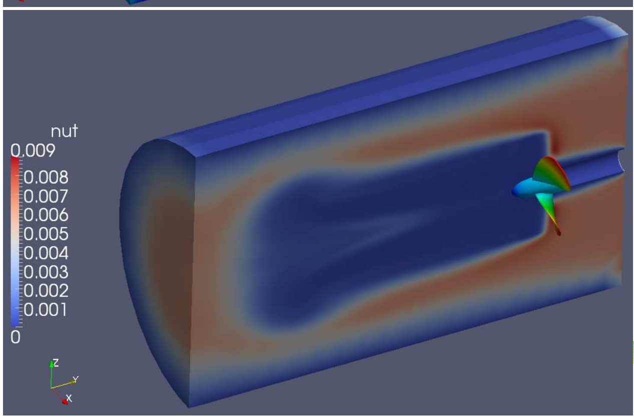
オープンCAE　第21回勉強会　　　　岐阜市生涯学習センター

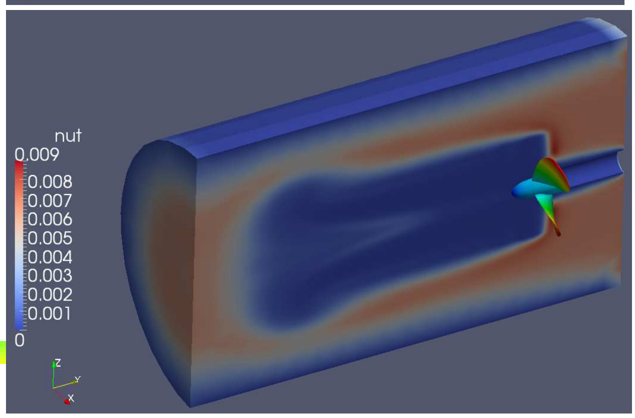
2-4. 計算の結果　（つづき）

流れ状態（最終時間　0.1s）　ほぼ同じ結果になっている事が分かる。



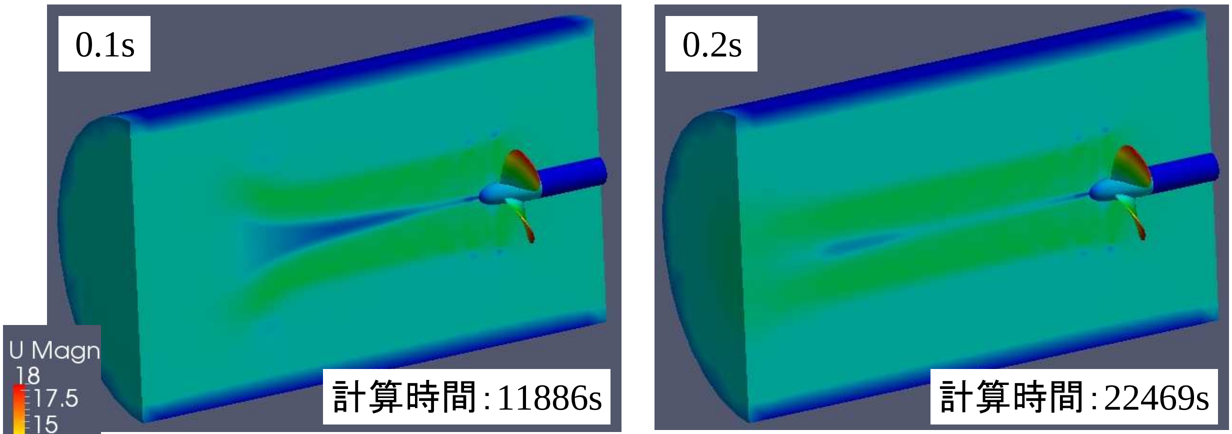






2-4．計算の結果（つづき）

チュートリアルの設定時間では流れがアウトレット端に達していないため，計算時間を0.2sまで延長してみました。



マウスPC　m-Book P
windows 7
VirtualBox 4.2

3．MRFの場合
（MRFSimpleFoam）

3-1．メッシュの作成

基本的なメッシュ作成は次の通り。AMIに比較して設定は少ない。

①計算に必要なファイルの設定
②blockMesh　基礎メッシュの作成
③surfaceFeatureExtract　特徴線の取出し
④snappyHexMesh　並列メッシュの準備
　全体メッシュの作成
⑤boundaryの調整

3-1．メッシュの作成 （つづき）

①計算に必要なファイルの設定

```
echo "Start mesh MRF"

CASE_DIR=case_set/case1/set
BLOCK_MESH=blockMeshDict_case1
DECOMPOSE_PAR=decomposeParDict_case1_mesh
SNAPPYHEXMESH_DICT=snappyHexMeshDict_case1
CONTROL_DICT=controlDict_case1_mesh
```

②基礎メッシュの作成（blockMeshの実施）

```
echo "blockMesh"
cp -r  $CASE_DIR/$CONTROL_DICT system/controlDict
cp -r  $CASE_DIR/$BLOCK_MESH constant/polyMesh/blockMeshDict
$runApplication blockMesh > log.blockMesh
```

③特徴線の取出し（surfaceFeatureExtractの実施）

```
echo "surfaceFeatureExtract"
$runApplication surfaceFeatureExtract -includedAngle 150 -minElem 10 constant/triSurface/innerCylinderSmall_m.stl   innerCylinderSmall_m
$runApplication surfaceFeatureExtract -includedAngle 150 -minElem 10 constant/triSurface/outerCylinder_m.stl        outerCylinder_m
$runApplication surfaceFeatureExtract -includedAngle 150 -minElem 10 constant/triSurface/propellerTip_m.stl         propellerTip_m
$runApplication surfaceFeatureExtract -includedAngle 150 -minElem 10 constant/triSurface/propellerStem2_m.stl       propellerStem2_m
$runApplication surfaceFeatureExtract -includedAngle 150 -minElem 10 constant/triSurface/propellerStem3_m.stl       propellerStem3_m
```

④並列メッシュの準備

```
echo "decomposePar 4 blocks"
cp -r  $CASE_DIR/$DECOMPOSE_PAR system/decomposeParDict
$runApplication decomposePar > log.decomposePar

echo "Copy data"
cp -r constant/triSurface/ processor0/constant/
cp -r constant/triSurface/ processor1/constant/
cp -r constant/triSurface/ processor2/constant/
cp -r constant/triSurface/ processor3/constant/
```

3-1. メッシュの作成 （つづき）

④全体メッシュの作成（snappyHexMeshの実施）

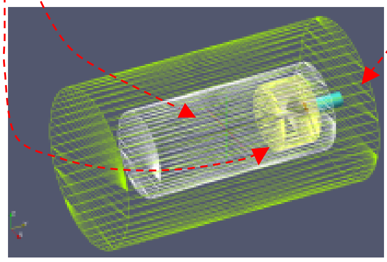
```
echo "snappyHexMesh 4CPU"
cp -r $CASE_DIR/$SNAPPYHEXMESH_DICT system/snappyHexMeshDict
$runApplication mpirun -np 4 snappyHexMesh -parallel > log.snappyHexMesh
```

境界層の作成あり

```
innerCylinderSmall_m.stl
{
    type        triSurfaceMesh;
    name        innerCylinderSmall;
}
```

```
outerCylinder_m.stl
{
    type        triSurfaceMesh;
    name        outerCylinder;
}

inlet_m.stl
{
    type        triSurfaceMesh;
    name        inlet;
}

outlet_m.stl
{
    type        triSurfaceMesh;
    name        outlet;
}
```

```
innerCylinder_temp
{
    type searchableCylinder;
    point1 (0 -0.6 0);
    point2 (0  0.1 0);
    radius 0.16;
}

outerCylinder_temp
{
    type searchableCylinder;
    point1 (0 -0.8 0);
    point2 (0  0.2 0);
    radius 0.30;
}
```



```
propellerTip_m.stl
{
    type        triSurfaceMesh;
    name        propellerTip;
}

propellerStem1_m.stl
{
    type        triSurfaceMesh;
    name        propellerStem1;
}

propellerStem2_m.stl
{
    type        triSurfaceMesh;
    name        propellerStem2;
}

propellerStem3_m.stl
{
    type        triSurfaceMesh;
    name        propellerStem3;
}
```


3-1. メッシュの作成 （つづき）

④全体メッシュの作成（snappyHexMeshの実施）

MRF領域

```
refinementSurfaces
{
    innerCylinderSmall
    {
        level       (4 4);
        faceZone rotate_area;
        cellZone rotate_area;
        zoneInside true;
    }

    outerCylinder
    {
        level       (0 0);
    }

    inlet
    {
        level       (0 0);
    }

    outlet
    {
        level       (0 0);
    }

    propellerTip
    {
        level       (4 5);
    }

    propellerStem1
    {
        level       (4 4);
    }

    propellerStem2
    {
        level       (4 4);
    }

    propellerStem3
    {
        level       (4 4);
    }
```

```
refinementRegions
{
    innerCylinder_temp
    {
        mode        inside;
        levels      ((1E15 3));
    }

    innerCylinderSmall
    {
        mode        inside;
        levels      ((1E15 4));
    }

    outerCylinder_temp
    {
        mode        inside;
        levels      ((1E15 0));
    }
}
```

3-1．メッシュの作成 （つづき）

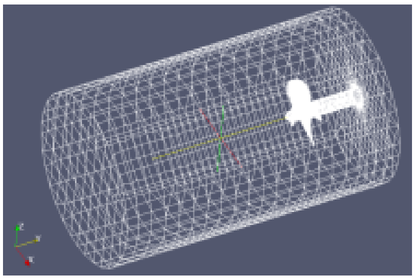
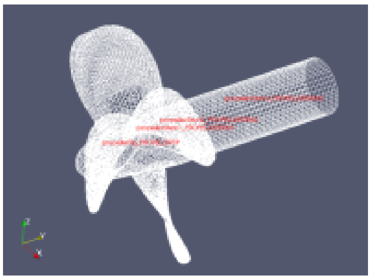
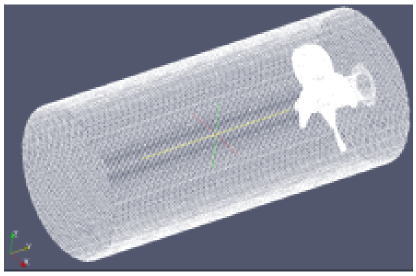
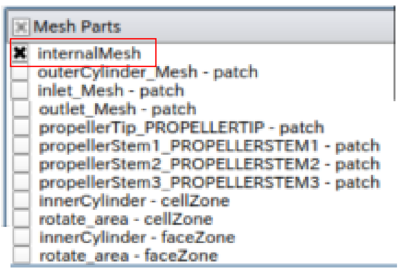
④全体メッシュの作成（snappyHexMeshの実施）

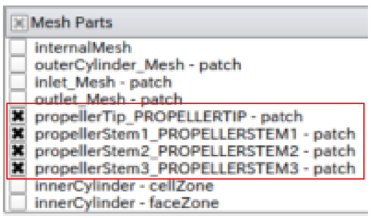
```
layers
{

    outerCylinder_Mesh
     {
         nSurfaceLayers 1;
     }

    propellerTip_PROPELLERTIP
     {
         nSurfaceLayers 1;
     }

    propellerStem1_PROPELLERSTEM1
     {
         nSurfaceLayers 1;
     }

    propellerStem2_PROPELLERSTEM2
     {
         nSurfaceLayers 1;
     }

    propellerStem3_PROPELLERSTEM3
     {
         nSurfaceLayers 1;
     }

}
```

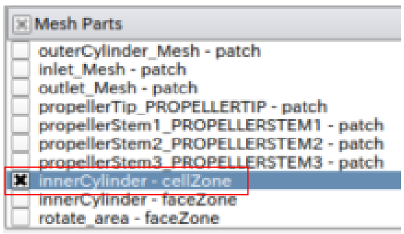
AMIは境界層がなかったが，MRFでは作成する

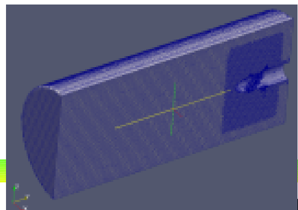
3-1．メッシュの作成 （つづき）

④全体メッシュの作成（snappyHexMeshの実施）

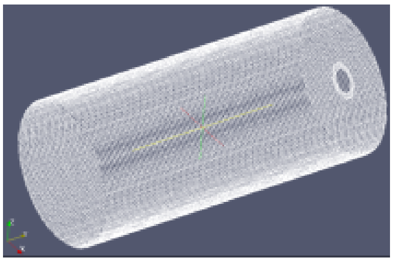
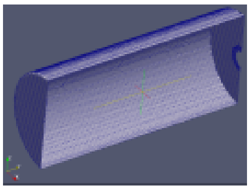
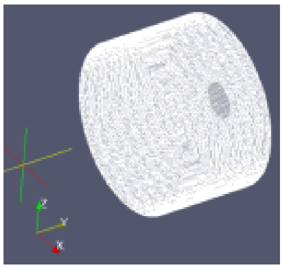
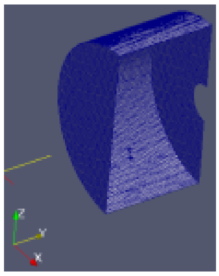


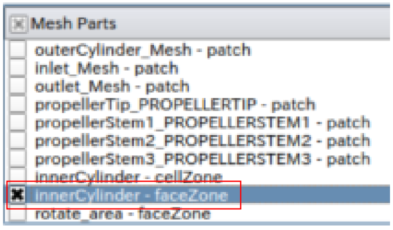


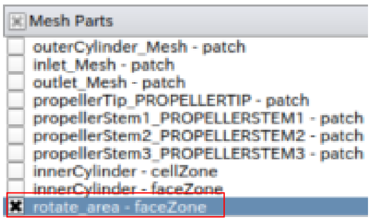


3-1．メッシュの作成 （つづき）

④全体メッシュの作成（snappyHexMeshの実施）





3-1．メッシュの作成 （つづき）

⑤boundaryの調整

```
8
(
    defaultFaces
    {
        type            empty;
        nFaces          0;
        startFace       1654624;
    }
//    innerCylinderSmall_INNERCYLINDERSMALL
//    {
//        type            wall;
//        nFaces          0;
//        startFace       1654624;
//    }
    outerCylinder_Mesh
    {
        type            wall;
        nFaces          640;
        startFace       1654624;
    }
    inlet_Mesh
    {
        type            patch;
        nFaces          652;
        startFace       1655264;
    }
    outlet_Mesh
    {
        type            patch;
        nFaces          112;
        startFace       1655916;
    }
```

コメントアウトにする

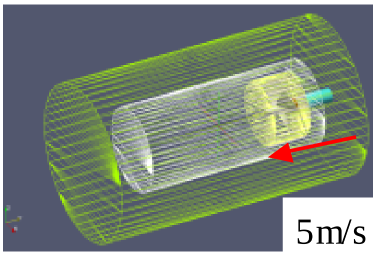
wallをpatchに変更する

```
    propellerTip_PROPELLERTIP
    {
        type            wall;
        nFaces          20846;
        startFace       1656028;
    }
    propellerStem1_PROPELLERSTEM1
    {
        type            wall;
        nFaces          189;
        startFace       1676874;
    }
    propellerStem2_PROPELLERSTEM2
    {
        type            wall;
        nFaces          576;
        startFace       1677063;
    }
    propellerStem3_PROPELLERSTEM3
    {
        type            wall;
        nFaces          1536;
        startFace       1677639;
    }
```

3-2. 計算の設定

乱流モデル（kEpsilon, kOmegaSST），初期設定値等はチュートリアル参照

●Uの設定

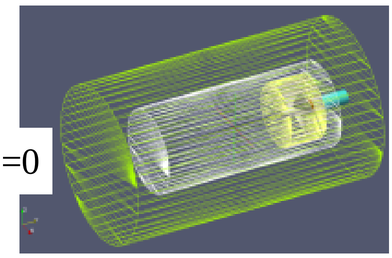



```
dimensions      [0 1 -1 0 0 0 0];

internalField   uniform (0 0 0);

boundaryField
{
    inlet_Mesh
    {
        type            fixedValue;
        value           uniform (0 -5 0);
    }

    outlet_Mesh
    {
        type            inletOutlet;
        inletValue      uniform (0 0 0);
        value           uniform (0 0 0);
    }

    outerCylinder_Mesh
    {
        type            fixedValue;
        value           uniform (0 0 0);
    }

    propellerTip_PROPELLERTIP
    {
        type            fixedValue;
        value           uniform (0 0 0);
    }

    propellerStem1_PROPELLERSTEM1
    {
        type            fixedValue;
        value           uniform (0 0 0);
    }

    propellerStem2_PROPELLERSTEM2
    {
        type            fixedValue;
        value           uniform (0 0 0);
    }

    propellerStem3_PROPELLERSTEM3
    {
        type            fixedValue;
        value           uniform (0 0 0);
    }
```


3-2. 計算の設定 （つづき）

●pの設定

```
dimensions      [0 2 -2 0 0 0 0];

internalField   uniform 0;

boundaryField
{
    inlet_Mesh
    {
        type            zeroGradient;
    }

    outlet_Mesh
    {
        type            fixedValue;
        value           uniform 0;
    }

    outerCylinder_Mesh
    {
        type            zeroGradient;
    }

    propellerTip_PROPELLERTIP
    {
        type            zeroGradient;
    }

    propellerStem1_PROPELLERSTEM1
    {
        type            zeroGradient;
    }

    propellerStem2_PROPELLERSTEM2
    {
        type            zeroGradient;
    }

    propellerStem3_PROPELLERSTEM3
    {
        type            zeroGradient;
    }
```



3-2. 計算の設定 （つづき）

●kの設定

```
dimensions      [0 2 -2 0 0 0 0];

internalField   uniform 0.06;

boundaryField
{
    inlet_Mesh
    {
        type            fixedValue;
        value           $internalField;
    }

    outlet_Mesh
    {
        type            inletOutlet;
        inletValue      $internalField;
        value           $internalField;
    }

    outerCylinder_Mesh
    {
        type            kqRWallFunction;
        value           $internalField;
    }

    propellerTip_PROPELLERTIP
    {
        type            kqRWallFunction;
        value           $internalField;
    }
```

```
propellerTip_PROPELLERTIP
{
    type            kqRWallFunction;
    value           $internalField;
}

propellerStem1_PROPELLERSTEM1
{
    type            kqRWallFunction;
    value           $internalField;
}

propellerStem2_PROPELLERSTEM2
{
    type            kqRWallFunction;
    value           $internalField;
}

propellerStem3_PROPELLERSTEM3
{
    type            kqRWallFunction;
    value           $internalField;
}
```


3-2. 計算の設定 （つづき）

●epsilonの設定

```
dimensions      [0 2 -3 0 0 0 0];

internalField   uniform 0.0495;

boundaryField
{
    inlet_Mesh
    {
        type            fixedValue;
        value           $internalField;
    }

    outlet_Mesh
    {
        type            inletOutlet;
        inletValue      $internalField;
        value           $internalField;
    }

    outerCylinder_Mesh
    {
        type            epsilonWallFunction;
        value           $internalField;
    }

    propellerTip_PROPELLERTIP
    {
        type            epsilonWallFunction;
        value           $internalField;
    }
```

```
propellerStem1_PROPELLERSTEM1
{
    type            epsilonWallFunction;
    value           $internalField;
}

propellerStem2_PROPELLERSTEM2
{
    type            epsilonWallFunction;
    value           $internalField;
}

propellerStem3_PROPELLERSTEM3
{
    type            epsilonWallFunction;
    value           $internalField;
}
```

3-2. 計算の設定（つづき）

●omegaの設定

ωの設定値は，k, εとωの関係から算出する。

Dissipation rate

The turbulent dissipation rate, ϵ, can be computed using the following formulas:

From the turbulence length scale

$$\epsilon = C_\mu^{\frac{3}{4}} \frac{k^{\frac{3}{2}}}{l}$$

Where C_μ is a turbulence model constant which usually has a value of 0.09, k is the turbulent energy and l is the turbulent length scale

From the turbulence length scale

$$\omega = C_\mu^{-\frac{1}{4}} \frac{\sqrt{k}}{l}$$

Where C_μ is a turbulence model constant which usually has a value of 0.09, k is the turbulent energy and l is the turbulent length scale

http://www.cfd-online.com/Wiki/Turbulence_free-stream_boundary_conditions

k, ε，Cμが与えられるからlを求める事ができる。
k，Cμ，lからωを計算する。

9.1667

3-2. 計算の設定（つづき）

●omegaの設定

```
dimensions [ 0 0 -1 0 0 0 0 ];

internalField uniform 9.1667;

boundaryField
{
  defaultFaces
  {
    type empty;
  }
    inlet_Mesh
    {
        type            fixedValue;
        value           $internalField;
    }

    outlet_Mesh
    {
        type            inletOutlet;
        inletValue      $internalField;
        value           $internalField;
    }

    outerCylinder_Mesh
    {
        type            omegaWallFunction;
        value           $internalField;
    }

    propellerTip_PROPELLERTIP
    {
        type            omegaWallFunction;
        value           $internalField;
    }
```

```
propellerStem1_PROPELLERSTEM1
{
    type            omegaWallFunction;
    value           $internalField;
}

propellerStem2_PROPELLERSTEM2
{
    type            omegaWallFunction;
    value           $internalField;
}

propellerStem3_PROPELLERSTEM3
{
    type            omegaWallFunction;
    value           $internalField;
}
```

3-2. 計算の設定 （つづき）

●nutの設定

```
dimensions      [0 2 -1 0 0 0 0];

internalField   uniform 0;

boundaryField
{
    inlet_Mesh
    {
        type            calculated;
        value           uniform 0;
    }

    outlet_Mesh
    {
        type            calculated;
        value           uniform 0;
    }

    outerCylinder_Mesh
    {
        type            nutkWallFunction;
        value           uniform 0;
    }

    propellerTip_PROPELLERTIP
    {
        type            nutkWallFunction;
        value           uniform 0;
    }

propellerStem1_PROPELLERSTEM1
{
    type            nutkWallFunction;
    value           uniform 0;
}

propellerStem2_PROPELLERSTEM2
{
    type            nutkWallFunction;
    value           uniform 0;
}

propellerStem3_PROPELLERSTEM3
{
    type            nutkWallFunction;
    value           uniform 0;
}
```

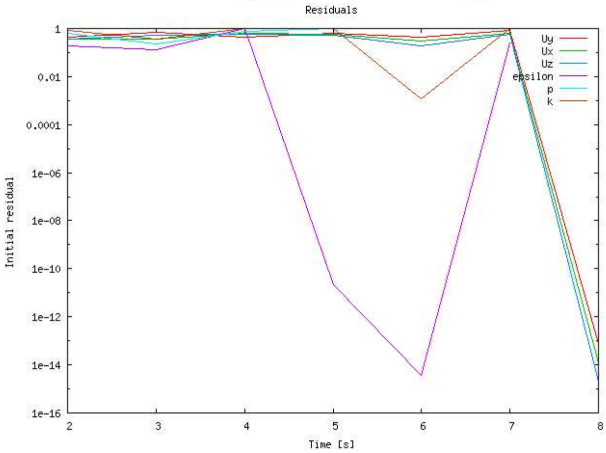

3-3. 計算の結果　kEpsilonモデル　計算1

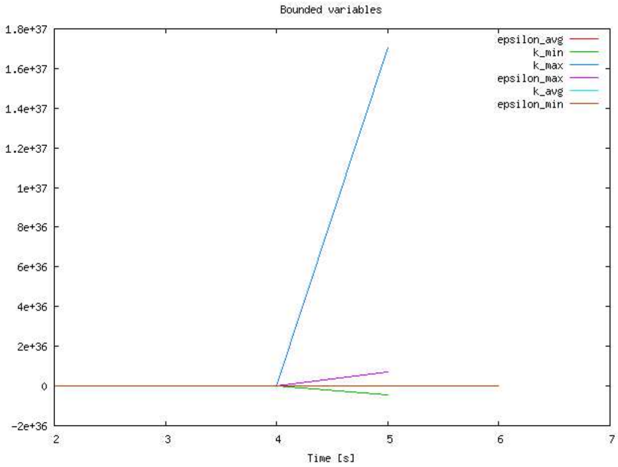
```
relaxationFactors
{
    p               0.3;
    U               0.7;
    k               0.7;
    epsilon         0.7;
    omega           0.7;
}

ddtSchemes
{
    default steadyState;
}

gradSchemes
{
    default         Gauss linear;
    grad(p)         Gauss linear;
    grad(U)         Gauss linear;
}

divSchemes
{
    default         none;
    div(phi,U)      Gauss limitedLinearV 1;
    div(phi,k)      Gauss limitedLinear 1;
    div((nuEff*dev(T(grad(U))))) Gauss linear;
    div(phi,epsilon) Gauss limitedLinear 1;
    div(phi,omega)  Gauss limitedLinear 1;
}

laplacianSchemes
{
    default         Gauss linear corrected;
}

interpolationSchemes
{
    default         linear;
    interpolate(U)  linear;
}

snGradSchemes
{
    default         corrected;
}

fluxRequired
{
    default         no;
    p;
}
```

計算発散

3-3. 計算の結果　kEpsilonモデル　計算1 （つづき）

```
Time = 7

smoothSolver:  Solving for Ux, Initial residual = 0.632955, Final residual = 0.0505158, No Iterations 2
smoothSolver:  Solving for Uy, Initial residual = 0.857437, Final residual = 0.0472142, No Iterations 2
smoothSolver:  Solving for Uz, Initial residual = 0.59659, Final residual = 0.0418494, No Iterations 2
GAMG:  Solving for p, Initial residual = 0.998716, Final residual = 5.37425e-16, No Iterations 1
time step continuity errors : sum local = 5.51732e+36, global = 9.77446e+22, cumulative = 9.77446e+22
smoothSolver:  Solving for epsilon, Initial residual = 0.259379, Final residual = 0.0178303, No Iterations 2
bounding epsilon, min: -1.25027e+78 max: 5.78742e+79 average: 8.39298e+74
smoothSolver:  Solving for k, Initial residual = 0.998341, Final residual = 0.0676582, No Iterations 4
bounding k, min: -2.90195e+70 max: 5.98937e+75 average: 2.78086e+71
ExecutionTime = 45.05 s  ClockTime = 46 s
```





3-3. 計算の結果　kEpsilonモデル　計算2

```
relaxationFactors
{
    p               0.2;
    U               0.5;
    k               0.5;
    epsilon         0.5;
    omega           0.5;
}
```

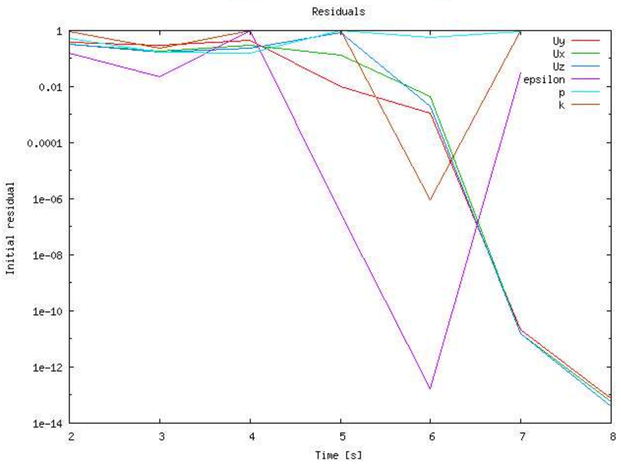
```
ddtSchemes
{
    default steadyState;
}

gradSchemes
{
    default         Gauss linear;
    grad(p)         Gauss linear;
    grad(U)         Gauss linear;
}

divSchemes
{
    default         none;
    div(phi,U)      Gauss limitedLinearV 1;
    div(phi,k)      Gauss limitedLinear 1;
    div((nuEff*dev(T(grad(U))))) Gauss linear;
    div(phi,epsilon) Gauss limitedLinear 1;
    div(phi,omega)  Gauss limitedLinear 1;
}

laplacianSchemes
{
    default         Gauss linear corrected;
}

interpolationSchemes
{
    default         linear;
    interpolate(U)  linear;
}
```

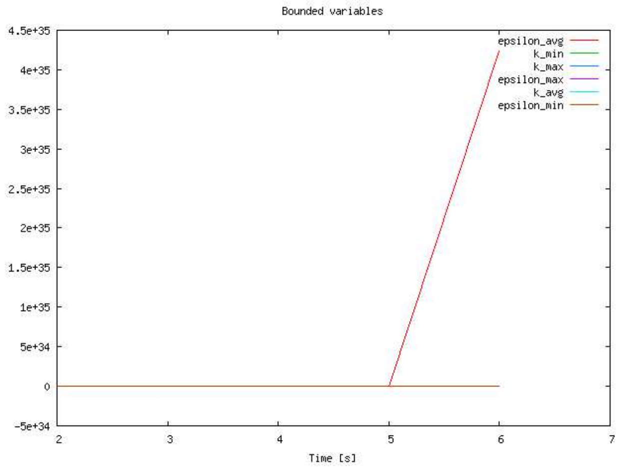
```
snGradSchemes
{
    default         corrected;
}

fluxRequired
{
    default         no;
    p;
}
```

計算発散

3-3. 計算の結果　kEpsilonモデル　計算２（つづき）

```
Time = 7

smoothSolver:  Solving for Ux, Initial residual = 1.61629e-11, Final residual = 1.61629e-11, No Iterations 0
smoothSolver:  Solving for Uy, Initial residual = 2.10684e-11, Final residual = 2.10684e-11, No Iterations 0
smoothSolver:  Solving for Uz, Initial residual = 1.57461e-11, Final residual = 1.57461e-11, No Iterations 0
GAMG:  Solving for p, Initial residual = 0.917942, Final residual = 3.01276e-05, No Iterations 1
time step continuity errors : sum local = 3.91495e+36, global = -5.24202e+27, cumulative = -5.24202e+27
smoothSolver:  Solving for epsilon, Initial residual = 0.0313248, Final residual = 0.00261953, No Iterations 3
bounding epsilon, min: -3.92517e+59 max: 1.50998e+61 average: 5.95486e+55
smoothSolver:  Solving for k, Initial residual = 1, Final residual = 0.000210672, No Iterations 1
bounding k, min: -1.53583e+56 max: 7.38131e+59 average: 1.67646e+54
ExecutionTime = 9.2 s  ClockTime = 10 s
```





3-3. 計算の結果　kEpsilonモデル　計算３

```
relaxationFactors
{
    p               0.2;
    U               0.5;
    k               0.5;
    epsilon         0.5;
    omega           0.5;
}
```

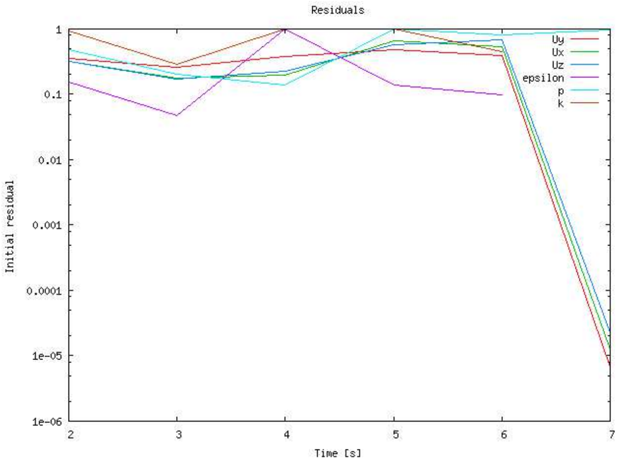
```
ddtSchemes
{
    default steadyState;
}

gradSchemes
{
    default         Gauss linear;
    grad(p)         Gauss linear;
    grad(U)         Gauss linear;
}

divSchemes
{
    default         none;
    div(phi,U)      Gauss upwind;
    div(phi,k)      Gauss upwind;
    div((nuEff*dev(T(grad(U))))) Gauss linear;
    div(phi,epsilon) Gauss upwind;
    div(phi,omega)  Gauss upwind;
}

laplacianSchemes
{
    default         Gauss linear corrected;
}

interpolationSchemes
{
    default         linear;
    interpolate(U)  linear;
}
```

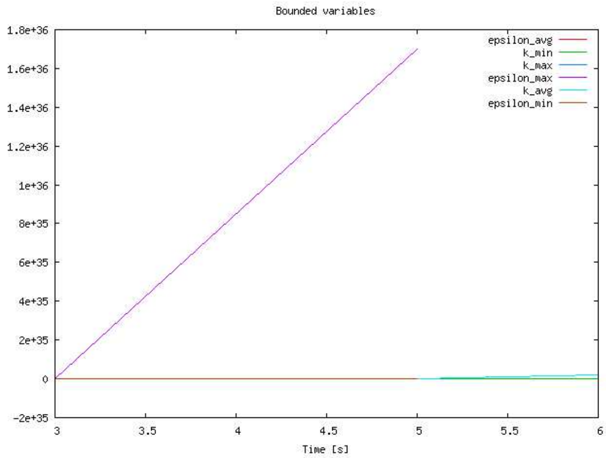
```
snGradSchemes
{
    default         corrected;
}

fluxRequired
{
    default         no;
    p;
}
```

計算発散

3-3. 計算の結果　kEpsilonモデル　計算3 （つづき）

```
Time = 6
Duration of pickling 0.168010950089 too long. Extending frequency from 1.0 to 8.40054750443

smoothSolver:  Solving for Ux, Initial residual = 0.531747, Final residual = 0.0140527, No Iterations 1
smoothSolver:  Solving for Uy, Initial residual = 0.394147, Final residual = 0.0238156, No Iterations 1
smoothSolver:  Solving for Uz, Initial residual = 0.679078, Final residual = 0.0416927, No Iterations 1
GAMG:  Solving for p, Initial residual = 0.800981, Final residual = 0.00407405, No Iterations 3
time step continuity errors : sum local = 8.73765e+21, global = 5.34834e+15, cumulative = 5.34835e+15
smoothSolver:  Solving for epsilon, Initial residual = 0.0971844, Final residual = 6.19357e-22, No Iterations 1
bounding epsilon, min: -1.60229e+46 max: 3.47438e+50 average: 7.58577e+44
smoothSolver:  Solving for k, Initial residual = 0.450318, Final residual = 0.0126855, No Iterations 2
bounding k, min: -2.58492e+29 max: 1.91267e+39 average: 1.84449e+34
ExecutionTime = 43.55 s  ClockTime = 44 s
```





3-3. 計算の結果　kEpsilonモデル　計算4

```
relaxationFactors
{
    p               0.2;
    U               0.5;
    k               0.2;
    epsilon         0.2;
    omega           0.2;
}
```

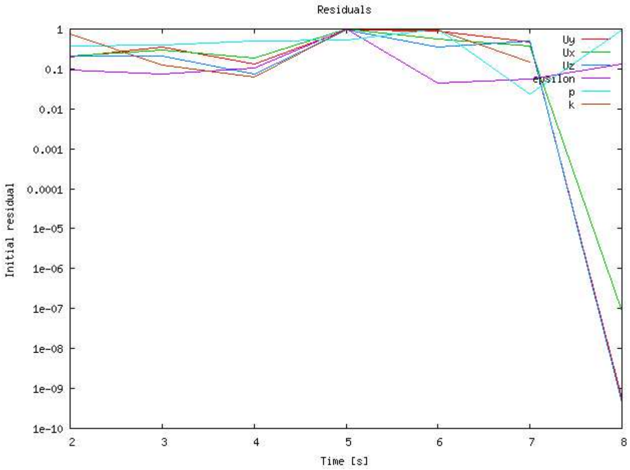
```
ddtSchemes
{
    default steadyState;
}

gradSchemes
{
    default         Gauss linear;
    grad(p)         Gauss linear;
    grad(U)         Gauss linear;
}

divSchemes
{
    default         none;
    div(phi,U)      Gauss upwind;
    div(phi,k)      Gauss upwind;
    div((nuEff*dev(T(grad(U))))) Gauss linear;
    div(phi,epsilon) Gauss upwind;
    div(phi,omega)  Gauss upwind;
}

laplacianSchemes
{
    default         Gauss linear corrected;
}

interpolationSchemes
{
    default         linear;
    interpolate(U)  linear;
}
```

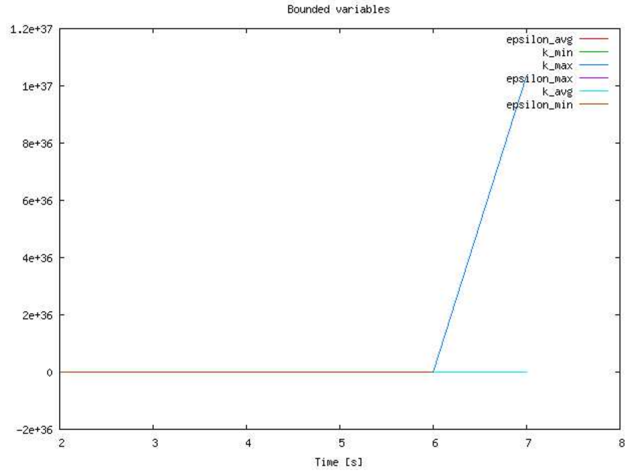
```
snGradSchemes
{
    default         corrected;
}

fluxRequired
{
    default         no;
    p;
}
```

計算発散

3-3. 計算の結果　kEpsilonモデル　計算4 （つづき）

```
Time = 7

smoothSolver:  Solving for Ux, Initial residual = 0.381412, Final residual = 0.01424, No Iterations 2
smoothSolver:  Solving for Uy, Initial residual = 0.467433, Final residual = 0.026653, No Iterations 1
smoothSolver:  Solving for Uz, Initial residual = 0.51482, Final residual = 0.0192993, No Iterations 2
GAMG:  Solving for p, Initial residual = 0.023446, Final residual = 8.0823e-05, No Iterations 2
time step continuity errors : sum local = 2.84011e+21, global = 1.18403e+16, cumulative = 1.18403e+16
smoothSolver:  Solving for epsilon, Initial residual = 0.056955, Final residual = 1.93157e-18, No Iterations 1
bounding epsilon, min: -5.94562e+40 max: 5.5518e+47 average: 1.1466e+42
smoothSolver:  Solving for k, Initial residual = 0.148176, Final residual = 0.00697955, No Iterations 1
bounding k, min: -7.18972e+26 max: 1.03455e+37 average: 7.5633e+31
ExecutionTime = 9.09 s  ClockTime = 10 s
```





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3-3. 計算の結果　kEpsilonモデル　計算5

```
relaxationFactors
{
    p               0.2;
    U               0.2;
    k               0.2;
    epsilon         0.2;
    omega           0.2;
}
```

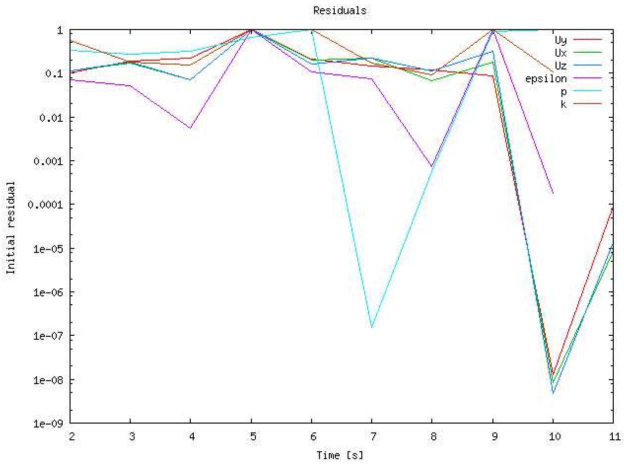
```
ddtSchemes
{
    default steadyState;
}

gradSchemes
{
    default         Gauss linear;
    grad(p)         Gauss linear;
    grad(U)         Gauss linear;
}

divSchemes
{
    default         none;
    div(phi,U)      Gauss upwind;
    div(phi,k)      Gauss upwind;
    div((nuEff*dev(T(grad(U))))) Gauss linear;
    div(phi,epsilon) Gauss upwind;
    div(phi,omega)  Gauss upwind;
}

laplacianSchemes
{
    default         Gauss linear corrected;
}

interpolationSchemes
{
    default         linear;
    interpolate(U)  linear;
}
```

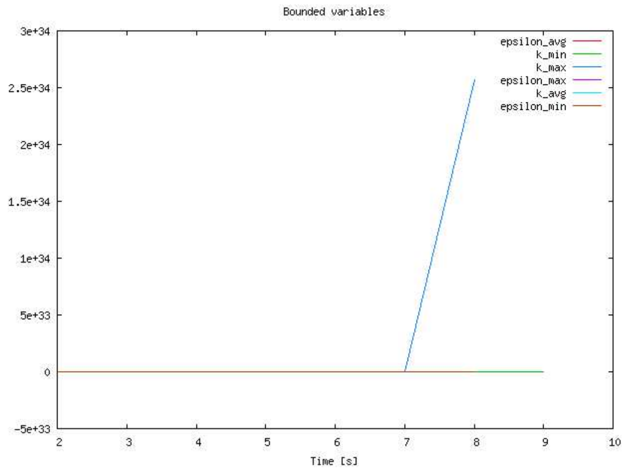
```
snGradSchemes
{
    default         corrected;
}

fluxRequired
{
    default         no;
    p;
}
```

計算発散

3-3. 計算の結果　kEpsilonモデル　計算5 （つづき）

```
Time = 10

smoothSolver:  Solving for Ux, Initial residual = 8.3024e-09, Final residual = 8.3024e-09, No Iterations 0
smoothSolver:  Solving for Uy, Initial residual = 1.24274e-08, Final residual = 1.24274e-08, No Iterations 0
smoothSolver:  Solving for Uz, Initial residual = 4.69885e-09, Final residual = 4.69885e-09, No Iterations 0
GAMG:  Solving for p, Initial residual = 0.978924, Final residual = 0.00742019, No Iterations 3
time step continuity errors : sum local = 1.5376e+36, global = -3.86778e+30, cumulative = -2.34726e+31
smoothSolver:  Solving for epsilon, Initial residual = 0.000179967, Final residual = 2.27605e-22, No Iterations 1
bounding epsilon, min: -6.56433e+87 max: 1.85098e+90 average: 6.70459e+84
smoothSolver:  Solving for k, Initial residual = 0.105415, Final residual = 0.00372074, No Iterations 2
bounding k, min: -6.58902e+54 max: 4.0462e+79 average: 1.71014e+74
ExecutionTime = 12.21 s  ClockTime = 13 s
```





3-3. 計算の結果　kEpsilonモデル　計算6

```
relaxationFactors
{
    p           0.1;
    U           0.1;
    k           0.1;
    epsilon     0.1;
    omega       0.1;
}
```

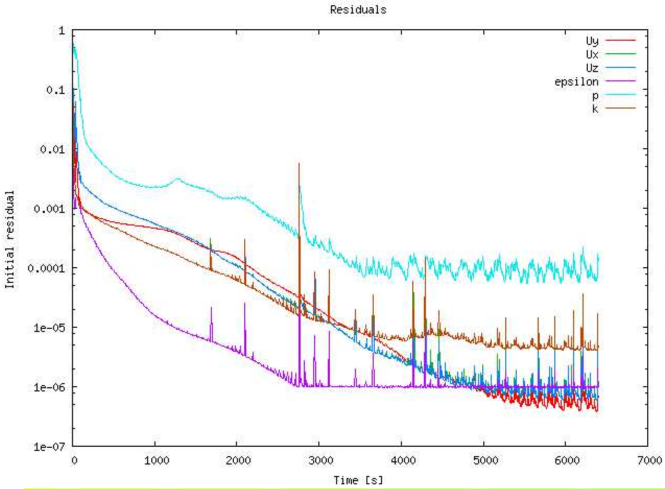
```
ddtSchemes
{
    default steadyState;
}

gradSchemes
{
    default         Gauss linear;
    grad(p)         Gauss linear;
    grad(U)         Gauss linear;
}

divSchemes
{
    default         none;
    div(phi,U)      Gauss upwind;
    div(phi,k)      Gauss upwind;
    div((nuEff*dev(T(grad(U))))) Gauss linear;
    div(phi,epsilon) Gauss upwind;
    div(phi,omega)  Gauss upwind;
}

laplacianSchemes
{
    default         Gauss linear corrected;
}

interpolationSchemes
{
    default         linear;
    interpolate(U)  linear;
}
```

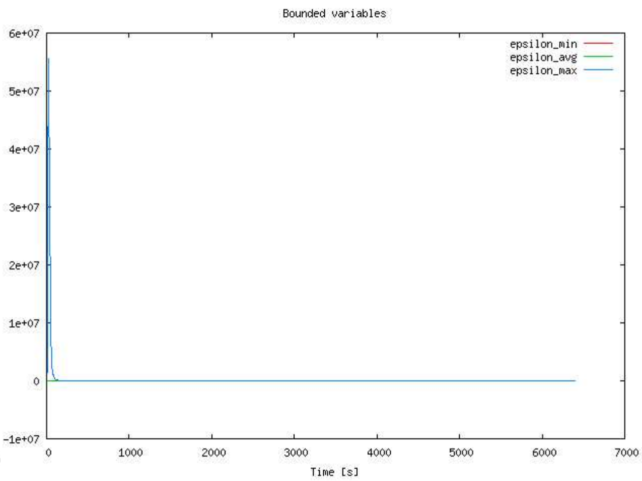
```
snGradSchemes
{
    default         corrected;
}

fluxRequired
{
    default         no;
    p;
}
```

ようやく収束

3-3. 計算の結果　kEpsilonモデル　計算6　（つづき）

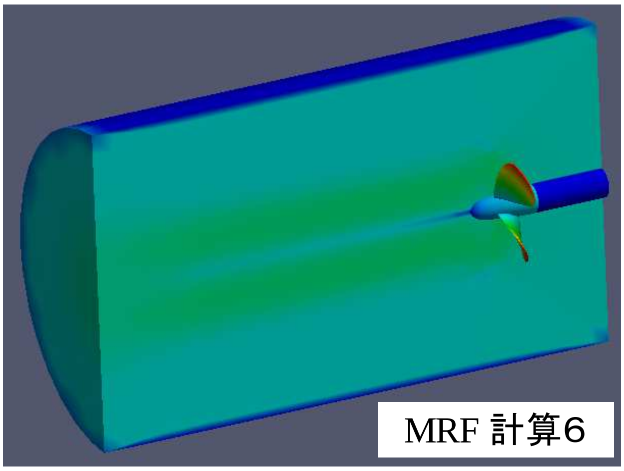
```
Time = 6400

smoothSolver:  Solving for Ux, Initial residual = 1.10438e-06, Final residual = 5.78879e-08, No Iterations 1
smoothSolver:  Solving for Uy, Initial residual = 6.66485e-07, Final residual = 6.66485e-07, No Iterations 0
smoothSolver:  Solving for Uz, Initial residual = 9.96759e-07, Final residual = 9.96759e-07, No Iterations 0
GAMG:  Solving for p, Initial residual = 0.000142396, Final residual = 7.46295e-07, No Iterations 4
time step continuity errors : sum local = 4.15964e-07, global = 2.09184e-08, cumulative = 0.00185233
smoothSolver:  Solving for epsilon, Initial residual = 1.01288e-06, Final residual = 4.84224e-08, No Iterations 1
smoothSolver:  Solving for k, Initial residual = 4.75201e-06, Final residual = 2.60611e-07, No Iterations 1
ExecutionTime = 6038.96 s  ClockTime = 6119 s
```

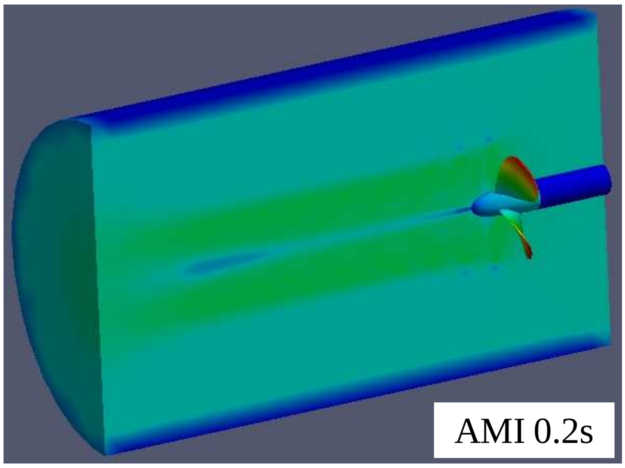


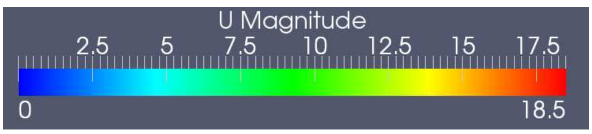


3-3. 計算の結果, kEpsilonモデルとAMIとの比較

乱流モデル：kEpsilonの場合 緩和係数を小さくしないと収束しない







3-3. 計算の結果　kOmegaSSTモデル　計算1

```
relaxationFactors
{
    p               0.3;
    U               0.7;
    k               0.7;
    epsilon         0.7;
    omega           0.7;
}
```

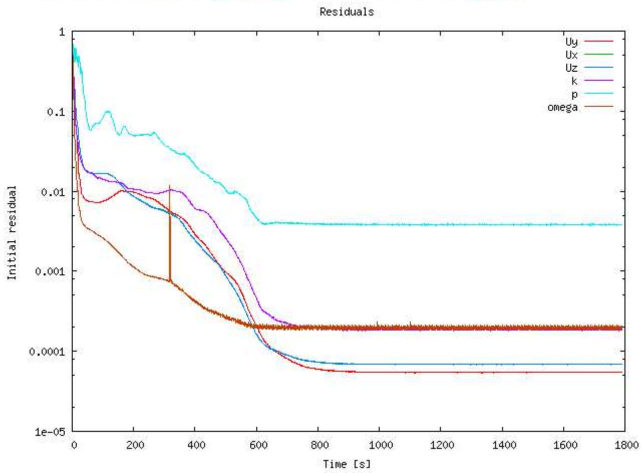
```
ddtSchemes
{
    default steadyState;
}

gradSchemes
{
    default         Gauss linear;
    grad(p)         Gauss linear;
    grad(U)         Gauss linear;
}

divSchemes
{
    default         none;
    div(phi,U)      Gauss limitedLinearV 1;
    div(phi,k)      Gauss limitedLinear 1;
    div((nuEff*dev(T(grad(U))))) Gauss linear;
    div(phi,epsilon) Gauss limitedLinear 1;
    div(phi,omega)  Gauss limitedLinear 1;
}

laplacianSchemes
{
    default         Gauss linear corrected;
}

interpolationSchemes
{
    default         linear;
    interpolate(U)  linear;
}
```

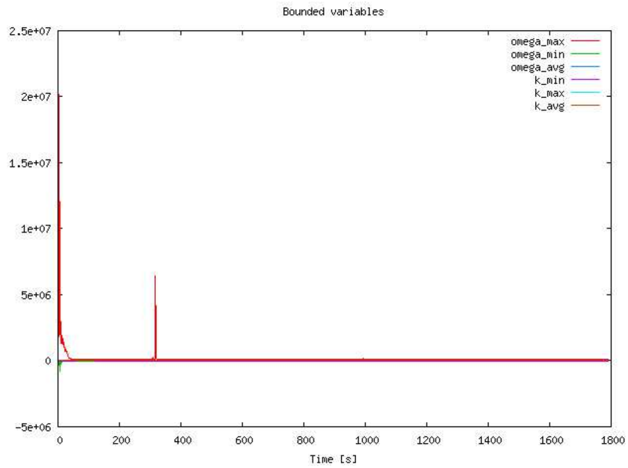
```
snGradSchemes
{
    default         corrected;
}

fluxRequired
{
    default         no;
    p;
}
```

計算収束

3-3. 計算の結果　kOmegaSSTモデル　計算1　（つづき）

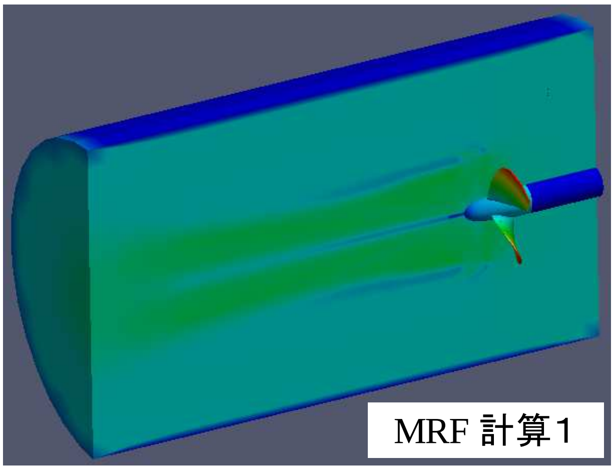
```
Time = 1791

smoothSolver:  Solving for Ux, Initial residual = 6.93341e-05, Final residual = 5.27737e-06, No Iterations 3
smoothSolver:  Solving for Uy, Initial residual = 5.50252e-05, Final residual = 2.52543e-06, No Iterations 4
smoothSolver:  Solving for Uz, Initial residual = 6.98301e-05, Final residual = 5.47412e-06, No Iterations 3
GAMG:  Solving for p, Initial residual = 0.00385135, Final residual = 1.76449e-05, No Iterations 3
time step continuity errors : sum local = 3.52956e-05, global = 1.42546e-06, cumulative = -0.208219
smoothSolver:  Solving for omega, Initial residual = 0.000187526, Final residual = 1.40394e-05, No Iterations 3
bounding omega, min: -2198.44 max: 121334 average: 1131.29
smoothSolver:  Solving for k, Initial residual = 0.000187131, Final residual = 1.18509e-05, No Iterations 3
bounding k, min: -0.0555937 max: 1.85087 average: 0.11719
ExecutionTime = 2095.16 s  ClockTime = 2123 s
```

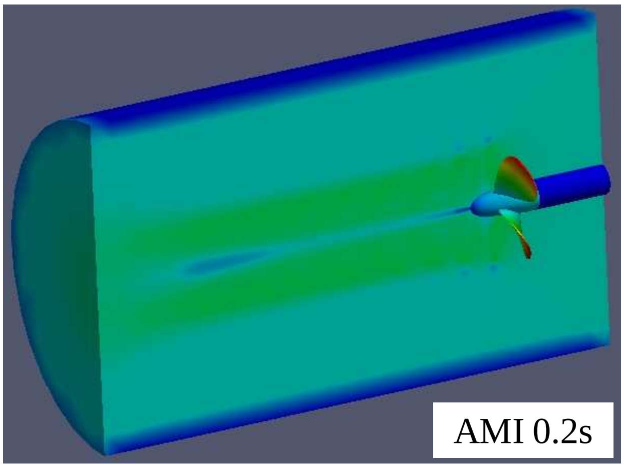


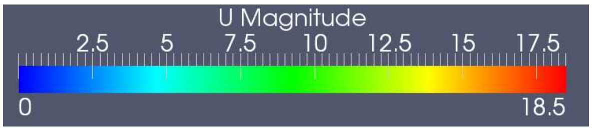


3-3. 計算の結果, kOmegaSSTモデルとAMIとの比較

乱流モデル: kOmegaSSTの場合 緩和係数はデフォルトで収束する

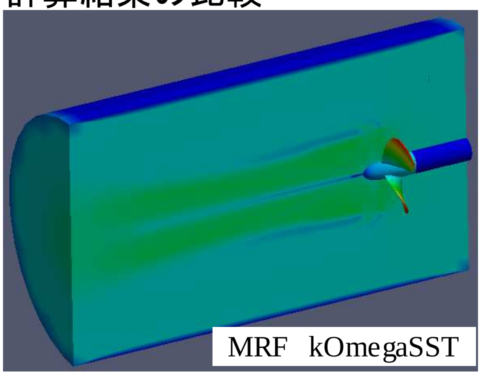


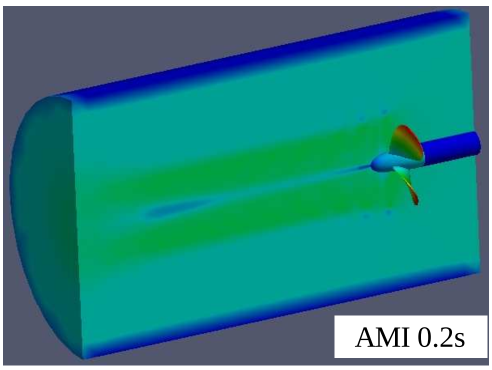


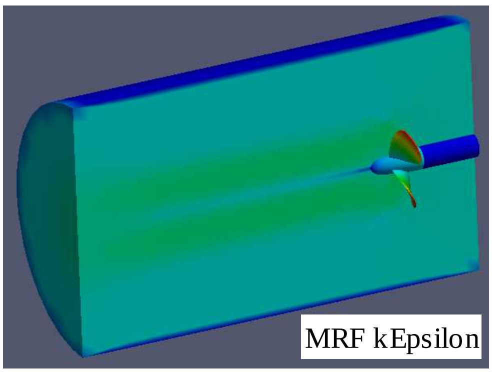


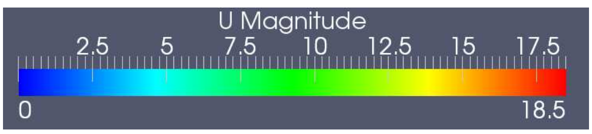
3-3. 計算結果の比較

計算時間は圧倒的にMRFの方が速い。AMI(0.2秒)に対してMRF kOmegaSSTは約1/10で計算できる









4. まとめ，その他

●まとめ

・AMIチュートリアルの中身をだいたい理解し，自分の方法でモデル作成を実施し，計算実行まで行った。

・AMIはMRFと比較して計算時間が大幅にかかる。