

非定常・一様境界条件の 設定方法

OpenFOAM® v2.1.0: New Boundary Conditions
Time-Dependent Conditions

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中川慎二

ウェブサイト情報 (新機能紹介)

OpenFOAM® v2.1.0: New Boundary Conditions

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Time-Dependent Conditions

Users can now initialise a range of boundary conditions (BCs) to be time-varying. This feature has been made available by incorporating the *DataEntry* class into BCs. The time-varying options are described below using the *uniformFixedValue* BC example, that requires the user to specify the value by the *uniformValue* keyword entry.

constant value

```
uniformValue constant 1.0;
```

inline table

```
uniformValue table
(
  ( 0 0.0)
  (100 10.0)
);
```

OpenFOAM table file

```
uniformValue tableFile;
tableFileCoeffs
{
  fileName "$FOAM_CASE/myDataFile"
  outOfBounds clamp;
}
```

CSV file

```
uniformValue csvFile;
csvFileCoeffs
{
  fileName "$FOAM_CASE/myDataFile"
  outOfBounds clamp;
  hasHeaderLine true;
  refColumn 0;
  componentColumns (0 1 2); // vector example
}
```

polynomial

```
uniformValue polynomial // y = 0.1 + 1.3x^2 + 2.7x^3
(
  (0.1 0)
  (1.3 2.0)
  (2.7 3.0)
);
```

<http://www.openfoam.org/version2.1.0/boundary-conditions.php>

ウェブサイト情報（新機能紹介）

The BCs that include time-varying options in v2.1.0 are:

- *flowRateInletVelocity*: inlet condition with time-varying flow-rate.
- *oscillatingFixedValue*: oscillatory fixed value condition with time-varying amplitude and frequency.
- *rotatingPressureInletOutletVelocity*: total pressure condition for a rotating patch with time-varying angular velocity.
- *rotatingTotalPressure*: total pressure condition for a rotating patch with time-varying angular velocity.
- *rotatingWallVelocity*: velocity condition for a rotating boundary, e.g. a wheel, with time-varying angular velocity.
- *uniformFixedValue*: general fixed value condition with time-varying value.
- *uniformTotalPressure*: total pressure condition with time-varying pressure.

The new handling of time-varying BCs makes the *timeVaryingFlowRateInletVelocity*, *timeVaryingUniformFixedValue* and *timeVaryingUniformTotalPressure* BCs redundant. They are therefore deprecated in v2.1.0.

Source code

finiteVolume library - \$FOAM_SRC/finiteVolume

DataEntry class - \$FOAM_SRC/OpenFOAM/primitives/functions/DataEntry

Example(s)

T-Junction example - \$FOAM_TUTORIALS/incompressible/pimpleFoam/TJunction

Oscillating box example - \$FOAM_TUTORIALS/incompressible/potentialFreeSurfaceFoam/oscillatingBox

TJunction例題での圧力境界

```
inlet
{
  type          uniformTotalPressure;
  pressure      table
  (
    (0 10)
    (1 40)
  );
  p0            40; // only used for restarts
  U             U;
  phi          phi;
  rho          none;
  psi          none;
  gamma       1;
  value       uniform 40;
}
```

uniformTotalPressure: **total pressure condition** with time-varying pressure.

oscillatingBox例題の速度境界

```
floatingObject
{
  type                oscillatingFixedValue;
  refValue            uniform (0 1 0);
  offset              (0 -1 0);
  amplitude           table
  (
    ( 0 0)
    ( 10 0.025)
    (1000 0.025)
  );
  frequency           constant 1;
  value              uniform (0 0 0);
}
```

oscillatingFixedValue: oscillatory fixed value condition **with time-varying amplitude and frequency**.

icoFoamのcavity例題で試す

- 元の例題
 - 上壁が一定の速度で動く
- 改造
 - 上壁の速度が, 時間とともに変化する
 - (0 0 0)@ 0秒 から (1 0 0)@ 1秒 へ, 直線変化

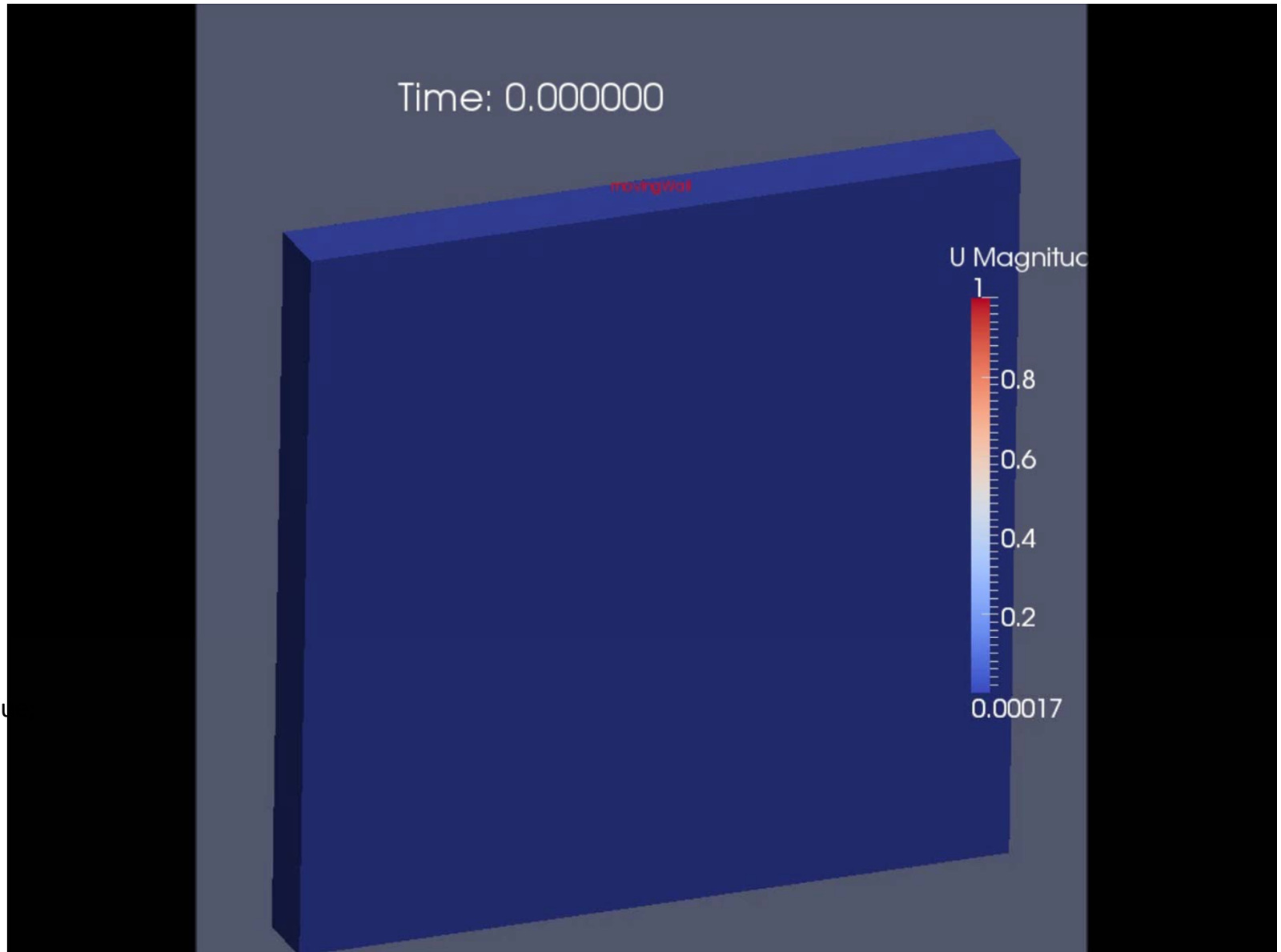
icoFoamのcavity例題で試す

0ディレクトリのUを次のように変更

```
movingWall
{
    //type      fixedValue;
    //value      uniform (1 0 0);
    type uniformFixedValue; //fixed value condition with time-varying value
    uniformValue table
    (
        ( 0 (0 0 0) ) // U(0 0 0) at 0s
        ( 1 (1 0 0) ) // U(1 0 0) at 1s
    );
}
```

icoFoamのcavity例題で試す

```
movingWall
{
  type uniformFixedValue
  uniformValue table
  (
    ( 0 (0 0 0) )
    ( 1 (1 0 0) )
  );
}
```

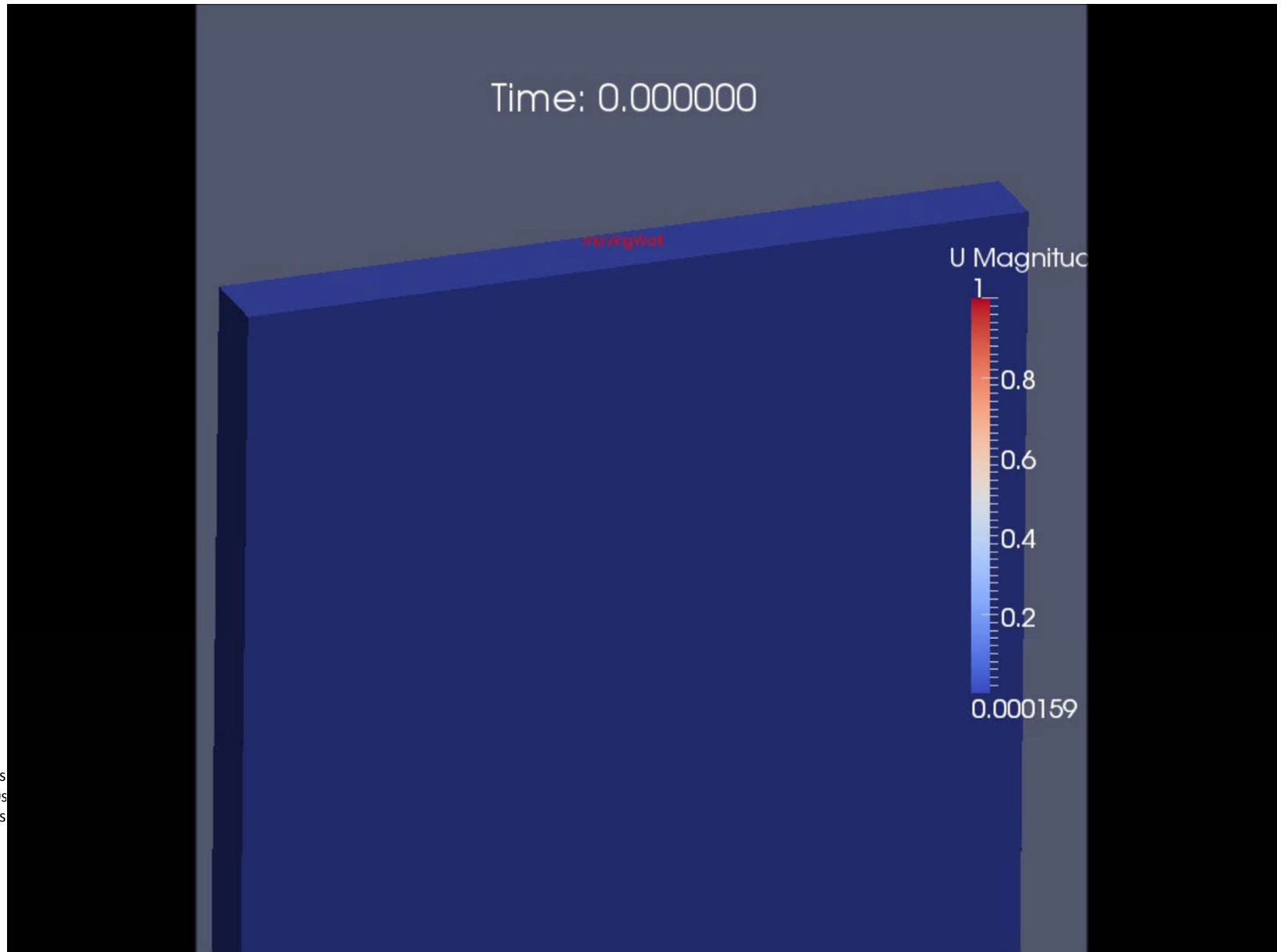


icoFoamのcavity例題: さらに改造

0ディレクトリのUを次のように変更

```
movingWall
{
    type uniformFixedValue;
    uniformValue table
    (
        ( 0   (0 0 0) ) // U(0 0 0) at 0s
        ( 0.5 (1 0 0) ) // U(0 0 0) at 0.5s
        ( 1   (0 0 0) ) // U(1 0 0) at 1s
    );
}
```

icoFoamのcavity例題：さらに改造



```
movingWall
{
  type uniformFixedValue;
  uniformValue table
  (
    (0 (0 0 0)) // U(0 0 0) at 0s
    (0.5 (1 0 0)) // U(0 0 0) at 0s
    (1 (0 0 0)) // U(1 0 0) at 1s
  );
}
```