XML GUIDE
FOR DUALSPHYSICS

COUPLING WITH MOORDYN+
SPECIAL: MOORDYN

July 2020

DualSPHysics team

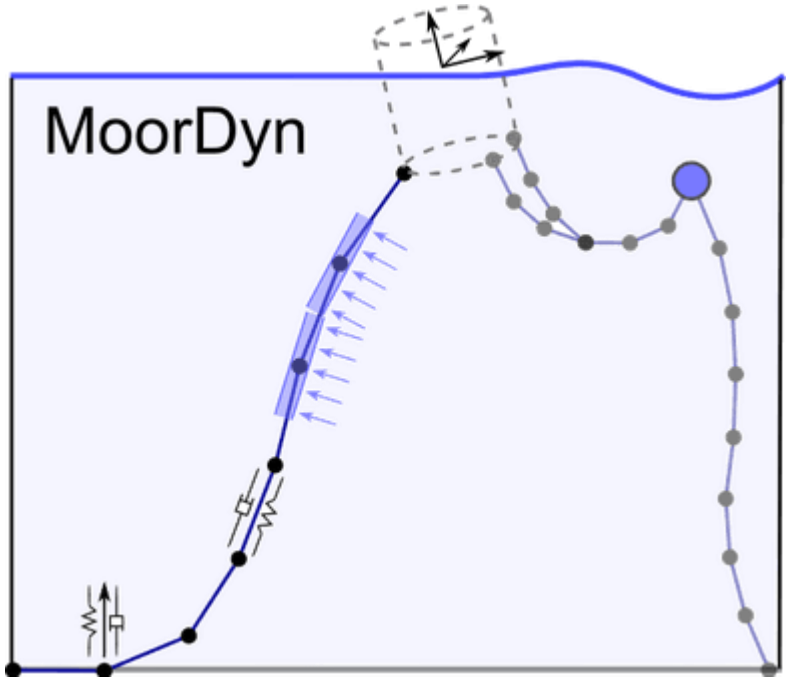
http://dual.sphysics.org

DualSPHysics has been coupled with MoorDyn+
https://github.com/imestevez/MoorDynPlus

MoorDyn+ is a new implementation of MoorDyn
http://www.matt-hall.ca/moordyn.html

MoorDyn is an open-source dynamic mooring line model developed by **Matt Hall**
MoorDyn discretizes mooring lines as point masses (nodes) connected
by linear spring-damper segments to provide elasticity in the axial direction.
MoorDyn uses a lumped-mass formulation for modelling:

- axial elasticity
- hydrodynamics
- bottom contact.



XML file: Special-Moorings

```
<special>
    <moorings>
        <savevtk_moorings value="true" />
        <savecsv_points value="true" />
        <savevtk_points value="false" />
        <mooredfloatings>
            <floating mkbound="45" />
            <floating mkbound="50" />
        </mooredfloatings>
        <moordyn file="moordyn.xml" />
    </moorings>
</special>
```

Saves VTK with moorings
Saves CSV with link points
Saves VTK with link points

mkbound of those moored objects

Configuration for the MoorDyn+ library can be defined in:

A) a new separated XML file

```
<moordyn file="moordyn.xml" comment="MoorDyn configuration"/>
```

B) in the same XML including this sections:

```
<moordyn>
    <solverOptions>
    <bodies>
    <lines>
    <output>
</moordyn>
```

XML file: Special-Moorings

```
<moordyn comment="MoorDyn configuration">
    <solverOptions>

        <waterDepth value="0.45" />
        <freesurface value="0" />
        <kBot value="3.0e6" />
        <cBot value="3.0e5" />
        <dtM value="0.001" />


        <frictionCoefficient value="0" />
        <fricDamp value="200" />
        <statDynFricScale value="1.0" />


        <dtIC value="1.0" />
        <cdScaleIC value="2" />
        <threshIC value="0.001" />
        <tmaxIC value="1" />

    </solverOptions>
    <bodies>
    <lines>
    <output>
</moordyn>
```

MORE INFORMATION:
http://www.matt-hall.ca/moordyn.html

-Water depth (m)
-Z position of free surface (m)
-Bottom stiffness constant (Pa/m)
-Bottom damping constant (Pa·s/m)
-Mooring model time step (s)

-Bottom friction coefficient
-Damping coefficient used to model friction at speeds near zero
-Ratio of static to dynamic friction

IC: initial conditions
-Period to analyse convergence of dynamic relaxation
-Factor to scale drag coefficients
-Convergence threshold
-Maximum time without convergence

XML file: Special-Moorings

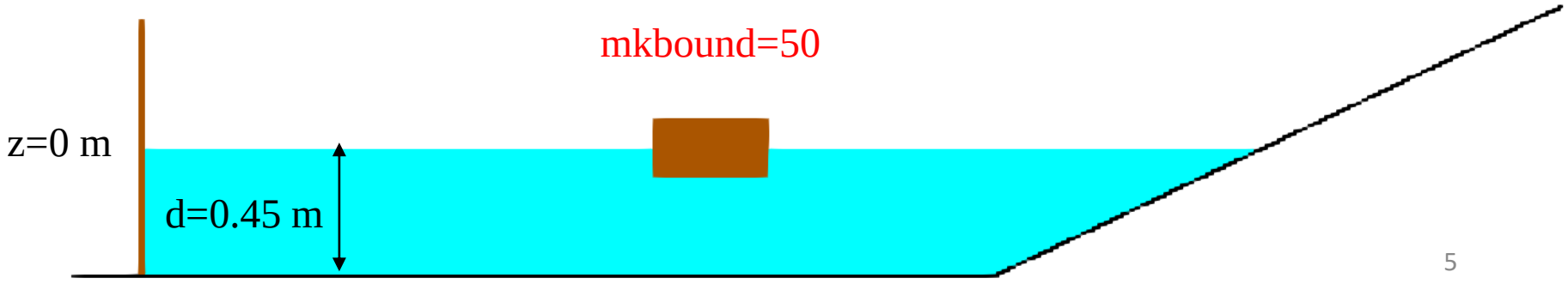
```
<moordyn comment="MoorDyn configuration">
    <solverOptions>
    <bodies>
        <body ref="50" />
    </bodies>
    <lines>
    <output>
</moordyn>
```

ref indicates which fluid-driven object will be moored

ref==mkbound

Fluid-driven object to attach mooring lines:

mkbound=50



XML file: Special-Moorings

```
<moordyn comment="MoorDyn configuration">
    <solverOptions>
    <bodies>
    <lines>
        <linedefault >
            <ea value="2.9e3" />
            <diameter value="3.656e-3" />
            <massDenInAir value="0.0607" />
            <ba value="-0.8" />
            <can value="1.0" />
            <cat value="0.0" />
            <cdn value="1.6" />
            <cdt value="0.05" />
            <breaktension value="500" />
            <outputFlags value="pv" />
        </linedefault>
        <line>  %line 0
        <line>  %line 1
    </lines>
    <output>
</moordyn>
```

Shared properties for each line

ea: line stiffness (N)
elasticity modulus * cross-sectional area

diameter: volume-equivalent diameter (m)

massDenInAir: mass per unit length (kg/m)

ba: internal damping (Ns)

can: transverse added mass coefficient

cat: tangential added mass coefficient

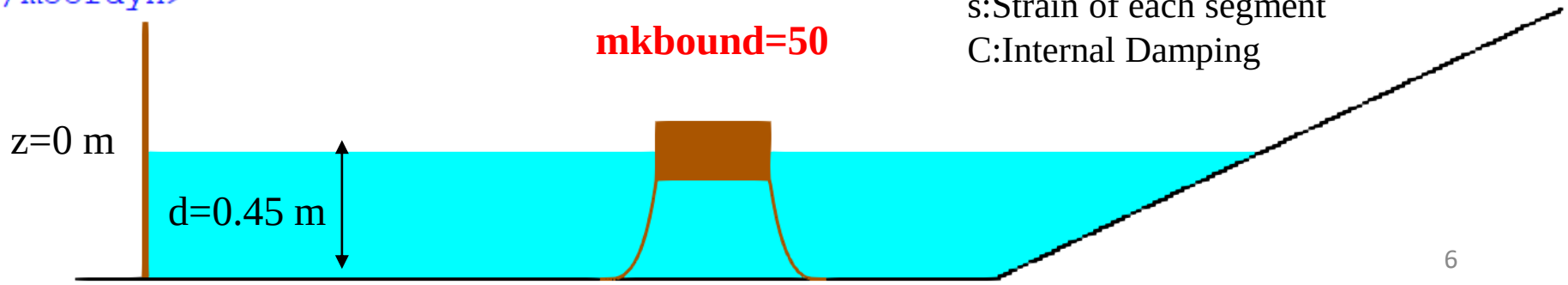
cdn: transverse drag coefficient

cdt: tangential drag coefficient

breaktension: Maximum value of tension (N)

outputFlags:

-:None, p:Positions, v:velocities
U:Wave Velocities, t:Tension
D:Hydrodynamic Drag Force
d: rate of strain of each segment
s:Strain of each segment
C:Internal Damping

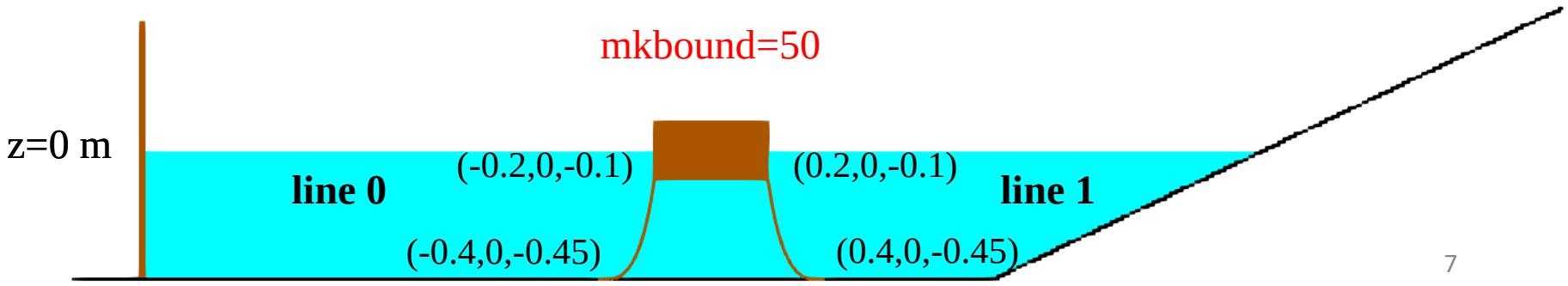


XML file: Special-Moorings

Connects the line to a fluid-driven object

```
<line>  %line 0
    <vesselconnection bodyref="50" x="-0.2" y="0.0" z="-0.1" />
    <fixconnection x="-0.4" y="0.0" z="-0.45" />
    <length value="0.45" />
    <segments value="40" />
    <breaktension value="300" />
</line>
<line>  %line 1
    <vesselconnection bodyref="50"  x="0.2" y="0.0" z="-0.1" />
    <fixconnection x="0.4" y="0.0" z="-0.45" />
    <length value="0.45" />
    <segments value="40" />
    <breaktension value="350" />
</line>
```

vesselconnection is attached to the body with ref=50



XML file: Special-Moorings

```
<moordyn comment="MoorDyn configuration">
    <solverOptions>
    <bodies>
    <lines>
    <output>
        <time startTime="0" endTime="10" dtOut="0.2" />
        <tension type="all" />
        <force type="all" />
        <velocity type="all" />
        <position type="all" />
    </output>
</moordyn>
```

Output data is saved since **startTime** till **endTime** every **dtOut** seconds

tension: stores tensions of connections types selected for each line
force: stores forces of connections types selected for each line
velocity: stores velocities of connections types selected for each line
position: stores positions of connections types selected for each line

type = fixed, vessel , all