

XML GUIDE FOR DUALSPHYSICS

**COUPLING WITH MOORDYNPLUS
SPECIAL: MOORINGS**



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DualSPHysics team

<http://dual.sphysics.org>

DualSPHysics has been coupled with MoorDynPlus
<https://github.com/imestevez/MoorDynPlus>



MoorDynPlus is a new implementation of MoorDynG
<http://www.matt-hall.ca/moordyn.html>

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

- axial elasticity
- hydrodynamics
- bottom contact.

XML file: **Special-Moorings**

```
<special>
  <moorings>
    <start value="4" ramptime="0" />
    <savevtk_lines value="true" />
    <savevtk_moorings value="true" />
    <savecsv_points value="true" />
    <savevtk_points value="false" />
    <mooredfloatings>
      <floating mkbound="45" />
      <floating mkbound="50" />
    </mooredfloatings>
    <moordynplus file="moordynplus.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 MoorDynPlus library can be defined in:

A) a new separated XML file

```
<moordynplus file="moordynplus.xml" />
```

B) in the same XML including this sections:

```
<moordynplusplus>
  <solverOptions>
  <bodies>
  <connects>
  <lines>
  <savedata>
</moordynplus>
```

XML file: **Special-Moorings**

```
<moordynplusplus>
  <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>
  <connects>
  <lines>
  <savedata>
</moordynplusplus>
```

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

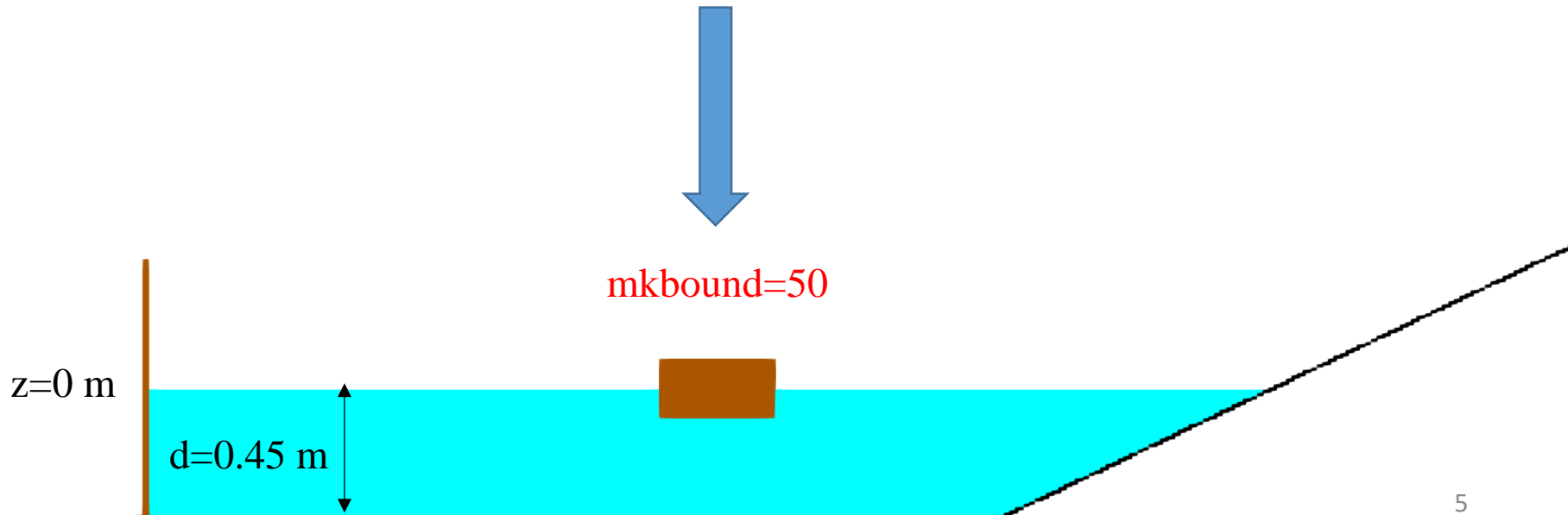
- Period to analyse convergence of dynamic relaxation
- Factor to scale drag coefficients
- Convergence threshold
- Maximum time without convergence

XML file: **Special-Moorings**

```
<moordynplusplus>
  <solverOptions>
  <bodies>
    <body ref="45"> %body 0
      <depth value="0.5"/>
    </body>
    <body ref="50"/> %body 1
  </bodies>
  <connects>
  <lines>
  <savedata>
</moordynplusplus>
```

ref indicates which fluid-driven
object will be moored
ref==mkbound

Fluid-driven object to attach mooring lines:
mkbound=50



XML file: **Special**-Mooring

```
<moordynplusplus>
  <solverOptions>
  <bodies>
  <connects>
  <lines>
    <linedefault>
      <e value="2.76246e+08"/>
      <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"/>
      <segments value="15"/>
      <length value="0.2"/>
    </linedefault>
    <line> %line 0
    <line> %line 1
  </lines>
  <savadata>
</moordynplusplus>
```

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

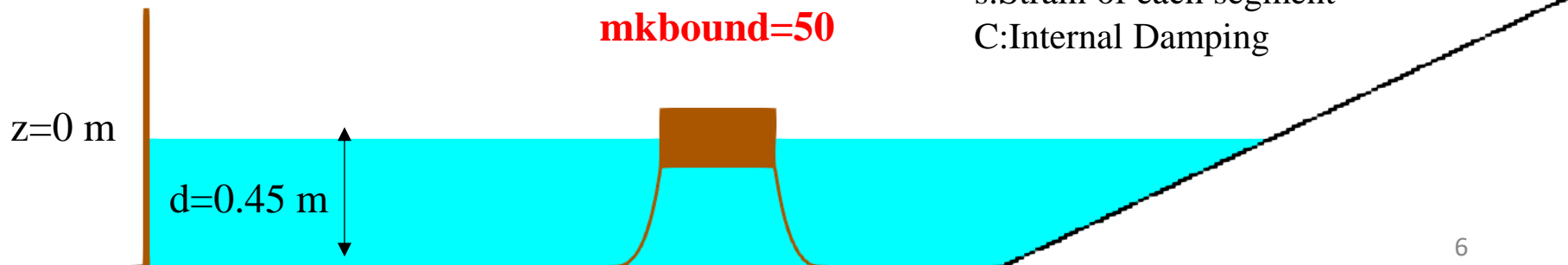
U:Wave Velocities, t:Tension

D:Hydrodynamic Drag Force

d: rate of strain of each segment

s:Strain of each segment

C:Internal Damping

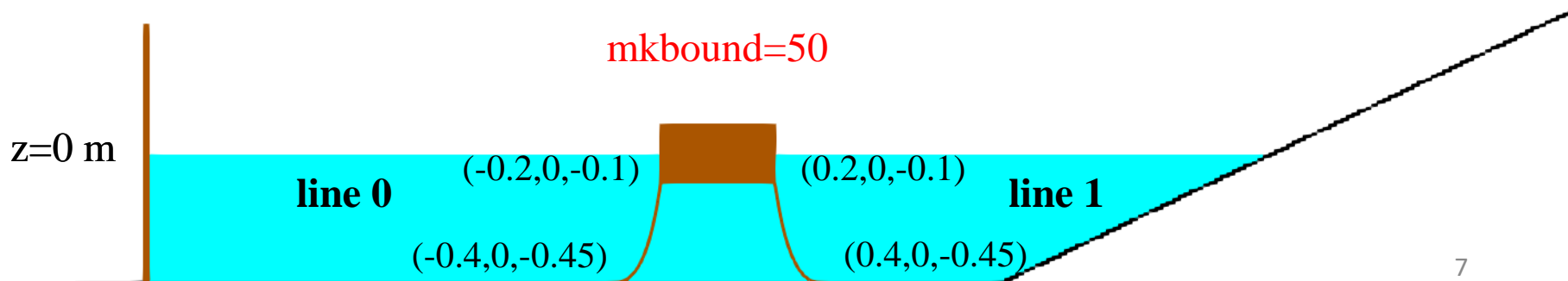


XML file: **Special-Moorings**

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**

```
<moordynplusplus>
  <solverOptions>
  <bodies>
  <connects>
  <lines>
  <savedata>
    <time startTime="0" endTime="4" dtOut="0.01"/>
    <tension value="true"/>
    <force value="true"/>
    <velocity value="true"/>
    <position value="true"/>
  </savedata>
</moordynplusplus>
```

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

tension: stores tensions of connections when value="true"

force: stores forces of connections when value="true"

velocity: stores velocities of connections when value="true"

position: stores positions of connections when value="true"

value = true, false