Model a spring-damper

base model: models/RevoluteJoint.mdl

final model: models/SpringDamper.mdl

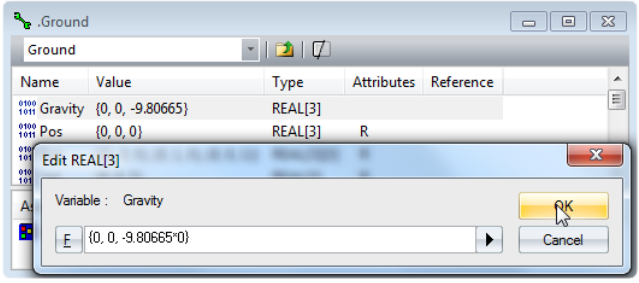
Explanations

- A spring-damper is an element which combines two effects, a spring and a damper
- The spring will cause forces or torques depending on translations or rotations
- The damper will cause forces and torques depending on velocities or angular velocities
- In alaska a spring-damper can be modeled using several force and torque elements
- Spring and damper may act in one or in more dimensions at a time
- Here we will exemplarily model a one-dimensional torsional spring-damper
- As template we will use **`TTorqueSingle`**
- Other possible elements to model spring-damper are **`TForceSingle`**, **`TForceVector`**, **`TTorqueVector`**, **`TForceTorqueVector`**, ...

Turn off gravity

Open the base model `RevoluteJoint.mdl` in alaska/ModellerStudio

1. First we want to turn off the gravity, to study the effects of the spring-damper, only
2. Double-click the `Ground` and then double-click the variable *`Gravity`*
3. Turn off the gravity, which is defined in $-z$-direction by setting it zero or multiplying by zero:



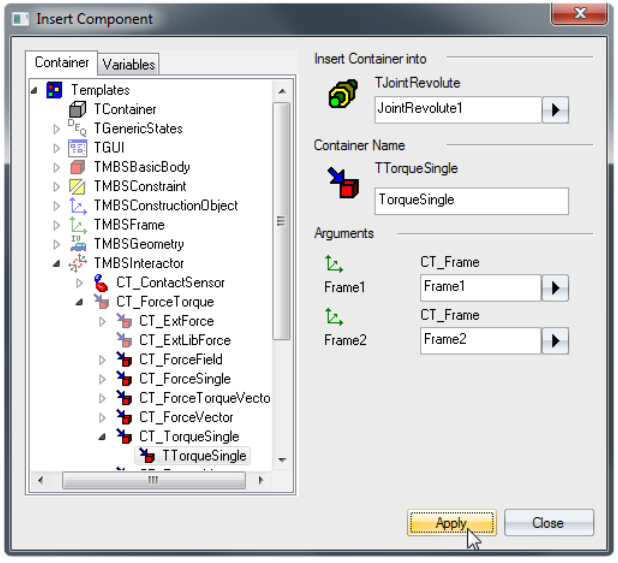
4. Now run the `Batch` to check that there is no motion in the current time-integration

Insert TorqueSingle

- We want to insert a torsional spring-damper in the revolute joint `JointRevolute1`
- We use the template **`TTorqueSingle`** which is an interactor and connects two Frames
- The torque will act about the three-axis of "`Frame2`" (similar to the revolute joint)
- We will make use of the Frames, we used to define the joint

1. Select the joint `JointRevolute1` and insert the template *`TMBSInteractor` → `CT_ForceTorque` → `CT_TorqueSingle` → `TTorqueSingle`*
2. As arguments select the defining Frames of the joint
   1. Frame1: `Frame1`
   2. Frame2: `Frame2`

Insert TorqueSingle



Insert TorqueSingle

3. Double-click `JointRevolute1.TorqueSingle` to open its "`Component View`"

- The **`TTorqueSingle`** element already calculates the revolution angle and angular velocity in its variables *`Rev`* and *`RevVel`*
- It also comes with a predefined force-law with a spring-damper using these variables
- So we only have to specify values for the spring and damping constant

4. Double-click the spring constant variable *`C`* and enter the number 1000
5. Double-click the damping constant variable *`K`* and enter the number 50
6. Now run the `Batch`

- You will see a damped oscillation of the pendulum
- The green double-headed arrow is the visualization of `TorqueSingle`

7. To rescale the visualization of the torque set the variable *`Viewer.ScaleInfo.ScaleArrowTorque`* to 1/200

Next tutorial

To have a closer look on the behavior of the spring-damper go on with the next tutorial Insert a Plot