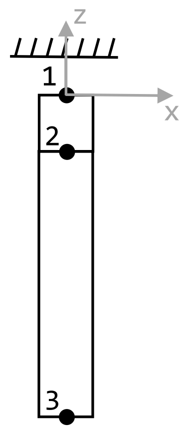
Test 3: Revolute joint

Schematic representation of the system (pendulum with a revolute joint at node 2):



Locations of the nodes:

Node	X [m]	Y [m]	Z [m]
1	0	0	0
2	0	0	-1
3	0	0	-6

The boundary conditions are:

~~Gravity acceleration: 9.81m/s^2.~~ Note that SubDyn doesn't account for the actual deflection of the substructure (e.g. pendulum amplitude). Accordingly, the system will be tested without gravity (no restoring force).

Imposed displacements at node 1:

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t = 0:0.01:50

x = t/200.*sin(2*pi*0.3*t)
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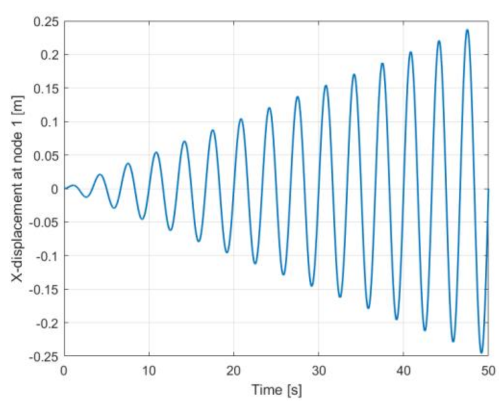


The velocity and acceleration at node 1 are prescribed by 1st and 2nd derivatives of the above expression.

Note that the other five directions *y*, *z*, *rx*, *ry*, *rz* at node 1 are constrained.

The beam properties are:

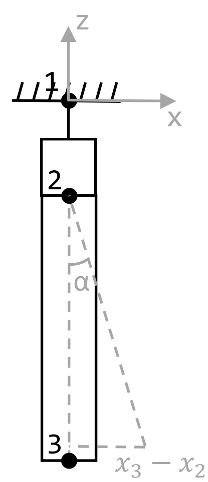
Young Modulus	Shear Modulus	Density	External diameter	Thickness
210E9 N/m^2	8.0769E10 N/m^2	7850 kg/m^3	0.2 m	0.02 m

Timoshenko beams are considered.

The revolute joint includes a rotational stiffness of 100 Nm/rad. ~~and a rotational damper of 750 Nms/rad~~ (note that the current version of SubDyn doesn't allow to account for a rotational damper yet).

Important notes: beam from node 1 to node 2 is included in the system since SubDyn doesn't allow to place a revolute joint at the interface joint (node 1). We are also forced to use a rotational stiffness since the rigid body modes are not allowed in the Craig-Bampton reduction.

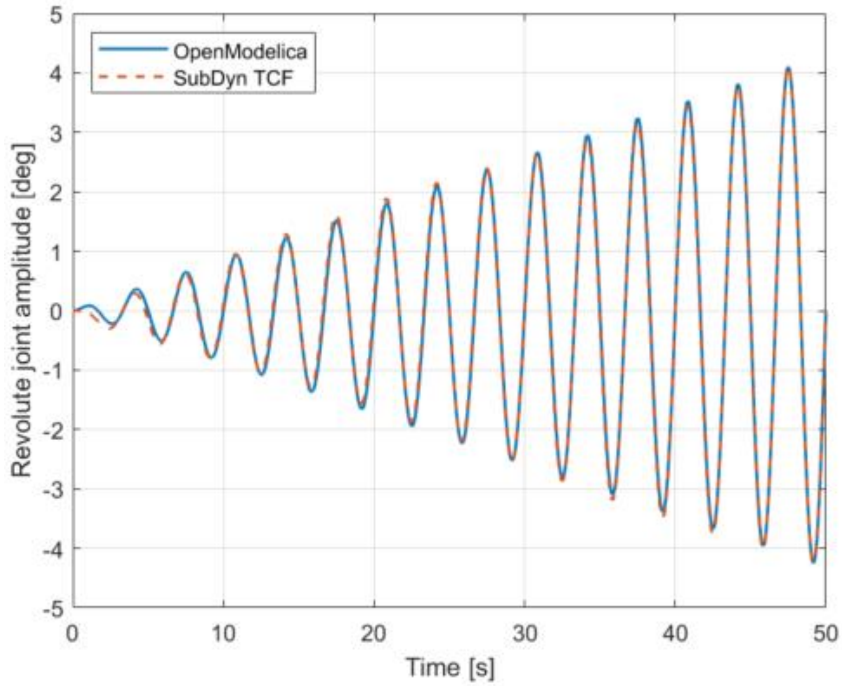
SubDyn doesn't provide the rotated angle by the revolute joint. But for this load case, the magnitude can be easily post-processed as follows:



$$sin(\alpha) = \frac{x_3 - x_2}{L_3 - L_2}$$

where $L_3 - L_2 = 5\ m.$

Response of the system:



As it can be observed, there is a good agreement between solutions. However, it is important to keep in mind that in real applications the gravity acceleration will be applied over the whole system according to its current position while SubDyn doesn't account for the actual deflection within the substructure.