Tutorial 23: Automatic Creation of a Missing Link and 3D Print of a Complete Model

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Complete List of all Tutorials with Publishable MATLAB Files of this Solid-Geoemtries Toolbox

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Motivation for this tutorial: (Originally SolidGeometry 3.1 required)

2. Open a system and create several fixed nodes and attach revolute joints
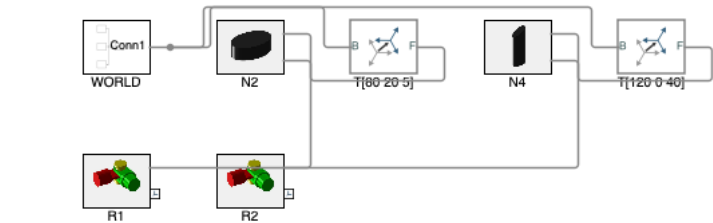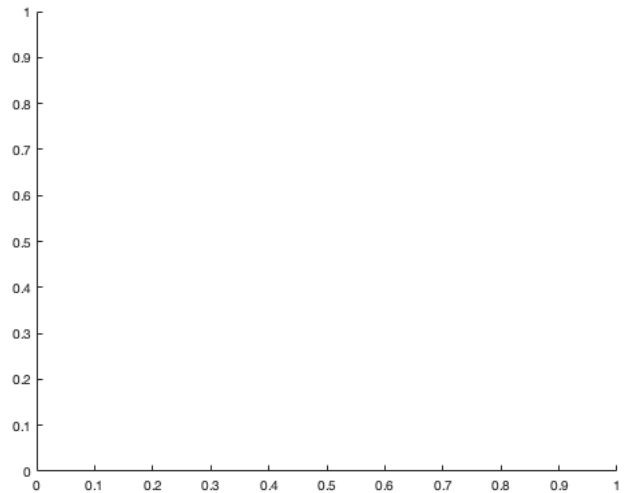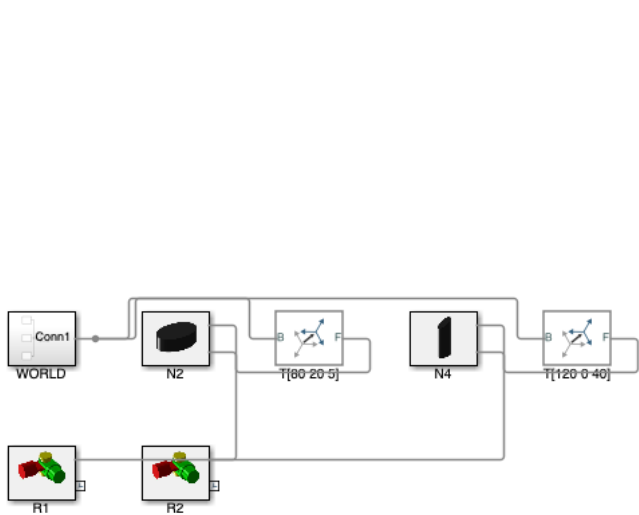
function VLFL_EXP23

```
smbNewSystem ('SG_LIB_EXP_23');

smbCreateSGNode ([80  20  5],'N2');
```

```
smbCreateSGNode ([120 0 40],'N4','',rot(0,-pi/8,0));
A=SGmodelJoint('R',pi/2);
smbCreateSGJoint('R','R1', A,'N4.F');
smbCreateSGJoint('R','R2',A,'N2.F');
smbDrawNow;
```

```
Creating temporary directory '/Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/'
ans =
     1     0     0
     0     0     1
     0    -1     0
ans =
     1     0     0
     0     0     1
     0    -1     0
```


3. Create a cylindric joint from two solids an attach it to revolute joint

```
Ro=5;
Ri=3;
slot=0.3;

C1=SGofCPLz([PLcircle(Ro);NaN NaN;PLcircle(Ri+slot)],30);
% C1=SGTset(C1,'B',TofSG(C1,'bottom','roty',pi));
C1=SGTset(C1,'B',TofSG(C1,'incenter','right',-1,'roty',pi/2,'5.1'));
C1=SGTset(C1,'F',TofSG(C1,'bottom','5.1'));
smbCreateSG(C1,'C1','r','R1_M');
D1=SGofCPLz(PLcircle(3),30);
D1=SGTset(D1,'B',TofSG(D1,'incenter'));
D1=SGTset(D1,'F',TofSG(D1,'top'));
```

```
ans =
     1     0     0
     0     0     1
     0    -1     0
ans =
     1     0     0
     0     0     1
     0    -1     0
```

4. Attach two frame sensor to record the movement of the falling cylinder

```
smbCreateSG(D1,'D1','g');
smbCreateConnection('C1.F','D1.B','C');
smbAddFrameSensor('R2_M.F');
smbAddFrameSensor('D1.F');
smbDrawNow;
```
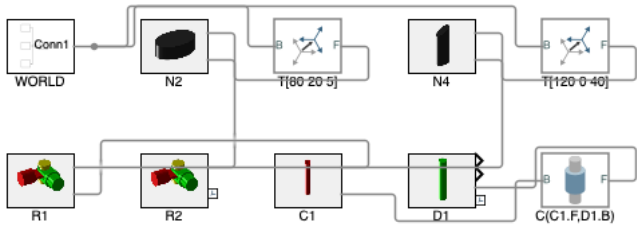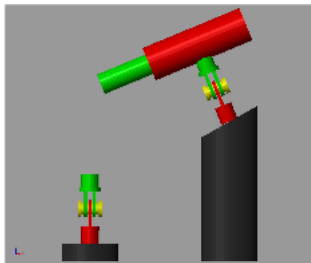

5. Show the Simulation

```
simOut=smbSimulate(0.1);
smbVideoSimulation(1);
```

...

6. Now create a solid between the revolute joint and cylindric joint

```
[T,ta]=smbTofSimOut(simOut,'R2_M.F'); T1=squeeze(T(:,:,1));
[T,tb]=smbTofSimOut(simOut,'D1.F');   T2=squeeze(T(:,:,1));
SG=SGof2T(T1,T2*TofR(rot(0,pi,0)),'',4); % Radius 4
SGTplot(SG);
```


7. Now connect the new solid in the model

```
smbCreateSG(SG,'SG','m');
smbCreateConnection('R2_M','SG.B');
% smbCreateConnection('D1.F','SG.F','align');   % removed because of a bug atarting 2023a which was still simluation correctly without movement in 2022
smbDrawNow;
```
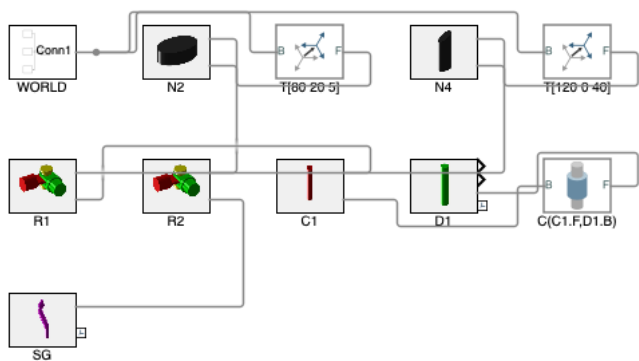
8. Show the Simulation: The Mechnism has no Movement anymore

```
smbVideoSimulation(0.1);
```

.
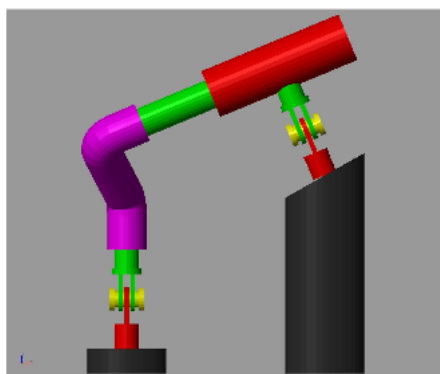
9. Now Create a Solid Model of Movement Status at Time = 0.1 Seconds

```
SG=smbFullModelSimulation(0.1);
SGfigure; SGplot(SG); view (7,20);
```

```
CREATING A FULL SOLID-MOVEMENT SIMULATION-MODEL 'SG_LIB_EXP_23' THAT RUNS At LEAST 0.10 SECONDS
=================================================================================================
Adding frame sensors for all solids of the model
Add frame sensors for 'C1.SG'
Add frame sensors for 'D1.SG'
Add frame sensors for 'N2.SG'
Add frame sensors for 'N4.SG'
Add frame sensors for 'R1.FIX1.SG'
Add frame sensors for 'R1_M.SG'
Add frame sensors for 'R1_S.SG'
Add frame sensors for 'R2.FIX1.SG'
Add frame sensors for 'R2_M.SG'
Add frame sensors for 'R2_S.SG'
Add frame sensors for 'SG.SG'
=================================================================================================
simOut =
  Simulink.SimulationOutput:
                simlog: [1x1 simscape.logging.Node]
                  sout: [1x1 Simulink.SimulationData.Dataset]
                  tout: [81x1 double]
                  xout: [1x1 Simulink.SimulationData.Dataset]

     SimulationMetadata: [1x1 Simulink.SimulationMetadata]
           ErrorMessage: [0x0 char]

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_C1.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 242
```

```
Number of vertices: 126
SGN2SGT: 2 Frames ('B', 'F') decoded in STL format.

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_D1.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 98
Number of vertices: 56
SGN2SGT: 2 Frames ('B', 'F') decoded in STL format.

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_N2.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 162
Number of vertices: 86
SGN2SGT: 2 Frames ('B', 'F') decoded in STL format.

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_N4.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 162
Number of vertices: 86
SGN2SGT: 2 Frames ('B', 'F') decoded in STL format.

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_R1.FIX1.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 249
Number of vertices: 133
SGN2SGT: 1 Frames ('B') decoded in STL format.

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_R1_M.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 473
Number of vertices: 243
SGN2SGT: 1 Frames ('B') decoded in STL format.

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_R1_S.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 465
Number of vertices: 167
SGN2SGT: 1 Frames ('B') decoded in STL format.

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_R2.FIX1.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 249
Number of vertices: 133
SGN2SGT: 1 Frames ('B') decoded in STL format.

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_R2_M.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 473
Number of vertices: 243
SGN2SGT: 1 Frames ('B') decoded in STL format.

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_R2_S.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 465
Number of vertices: 167
SGN2SGT: 1 Frames ('B') decoded in STL format.

LOADING BINARY STL-File: /Users/timlueth/Desktop/tmp_SG_LIB_EXP_23/sbm_temp_SG.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/tmp_SG_LIB_E
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 810
Number of vertices: 412
SGN2SGT: 2 Frames ('B', 'F') decoded in STL format.


CREATED A SOLID GEOMETRY OF THE FULL SIMULATION-MODEL 'SG_LIB_EXP_23' AT TIME: 0.10 SECONDS
================================================================================================
```
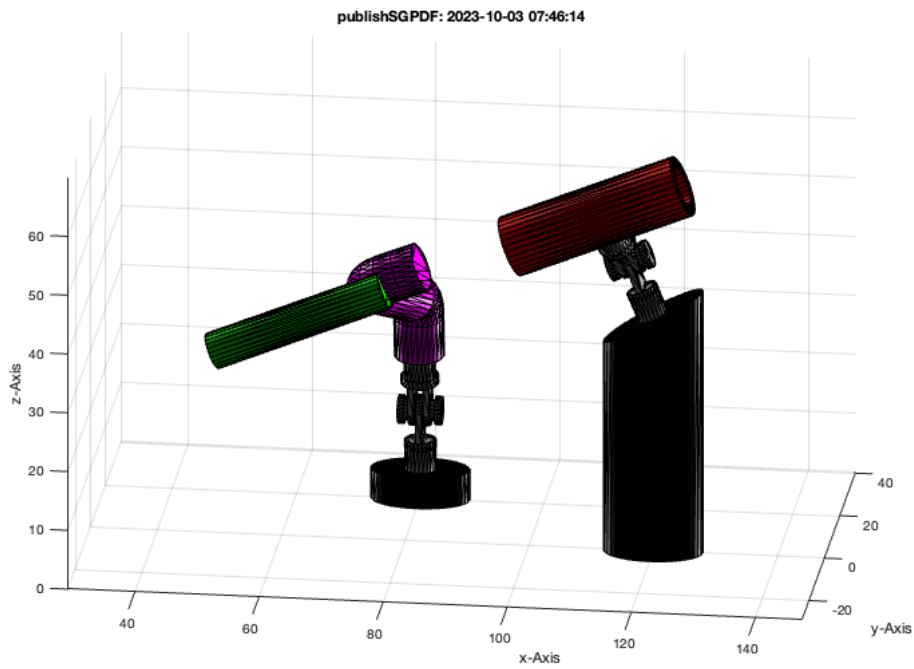
publishSGPDF: 2023-10-03 07:46:14

Write the STL file on disk for 3D printing

```
SGwriteSTL(SG);
```

```
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop')">/Users/timlueth/Desktop/</a><a href = "matlab: openbydoubleclick ('/User
```

Final Remarks

```
VLFLlicense
close all
```

```
This VLFL-Lib, Rel.  (2023-Oct-03), is for limited non commercial educational use only!
Licensee: Tim Lueth (Development Version)!
Please contact Tim Lueth, Professor at TU Munich, Germany!
WARNING: This VLFL-Lib (Rel. ) license will exceed at 06-Jul-2078 07:46:14!
Executed 03-Oct-2023 07:46:16 by 'timlueth' on a MACI64 using Mac OSX 13.6 | R2023a Update 5 | SG-Lib 5.4
========================================= Used Matlab products: =========================================
distrib_computing_toolbox
fixed_point_toolbox
map_toolbox
matlab
simmechanics
simscape
simulink
=========================================================================================================
```

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