Tutorial 29: Create a multi body simulation using several mass points

2017-03-17: Tim C. Lueth, MIMED - Technische Universität München, Germany (URL: http://www.mimed.de) - Last Change: 2017-07-07

Contents

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

The following topics are covered an explained in the specific tutorials:

- Tutorial 01: First Steps Using the VLFL-Toolbox for Solid Object Design
- Tutorial 02: Using the VLFL-Toolbox for STL-File Export and Import
- Tutorial 03: Closed 2D Contours and Boolean Operations in 2D
- Tutorial 04: 2½D Design Using Boolean Operators on Closed Polygon Lists (CPL)
- Tutorial 05: Creation, Relative Positioning and Merging of Solid Geometries (SG)
- Tutorial 06: Relative Positioning and Alignment of Solid Geometries (SG)
- Tutorial 07: Rotation of Closed Polygon Lists for Solid Geometry Design
- Tutorial 08: Slicing, Closing, Cutting and Separation of Solid Geometries
- Tutorial 09: Boolean Operations with Solid Geometries
- Tutorial 10: Packaging of Sets of Solid Geometries (SG)
- Tutorial 11: Attaching Coordinates Frames to Create Kinematik Models
- Tutorial 12: Define Robot Kinematics and Detect Collisions
- Tutorial 13: Mounting Faces and Conversion of Blocks into Leightweight-structures
- Tutorial 14: Manipulation Functions for Closed Polygons and Laser Cutting (SVG)
- Tutorial 15: Create a Solid by 2 Closed Polygons
- Tutorial 16: Create Tube-Style Solids by Succeeding Polygons
- Tutorial 17: Filling and Bending of Polygons and Solids
- Tutorial 18: Analyzing and modifying STL files from CSG modeler (Catia)
- Tutorial 19: Creating drawing templates and dimensioning from polygon lines
- Tutorial 20: Programmatically Interface to SimMechanics Multi-Body Toolbox
- Tutorial 21: Programmatically Convert Joints into Drives (SimMechanics)
- Tutorial 22: Adding Simulink Signals to Record Frame Movements
- Tutorial 23: Automatic Creation of a Missing Link and 3D Print of a Complete Model
- Tutorial 24: Automatic Creation of a Joint Limitations
- Tutorial 25: Automatic Creation of Video Titels, Endtitels and Textpages
- Tutorial 26: Create Mechanisms using Universal Planar Links
- Tutorial 27: Fourbar-Linkage: 2 Pose Syntheses and Linkage Export for 3D Printing
- Tutorial 28: Fourbar-Linkage: 3 Pose Syntheses and Linkage Export for 3D Printing
- Tutorial 29: Create a multi body simulation using several mass points
- Tutorial 30: Creating graphical drawings using point, lines, surfaces, frames etc.
- Tutorial 31: Importing 3D Medical DICOM Image Data and converting into 3D Solids
- Tutorial 32: Exchanging Data with a FileMaker Database
- Tutorial 33: Using a Round-Robin realtime multi-tasking system
- Tutorial 34: 2D Projection Images and Camera Coordinate System Reconstruction
- Tutorial 35: Collection of Ideas for Tutorials
- Tutorial 36: Creating a Patient-Individual Arm-Skin Protector-Shell

Motivation for this tutorial: (Originally SolidGeometry 3.6 required)

```
% function VLFL_EXP29
```

Motivation for this tutorial

Showing a finite element mass spring system

1. Create a SimMultiBody system for a Mass - Spring - Damper - System

```
smbNewSystem ('SG_LIB_EXP_29',[0 0 -9.81])    % Creates the mechansim diagramm
```

```
Creating temporary directory '/Users/timlueth/Desktop/tmp_SG_LIB_EXP_29/'
```


2 Create four mass points

```
smbCreateSGMass;
smbCreateSGMass;
smbCreateSGMass;
smbCreateSGMass;
smbDrawNow;
```
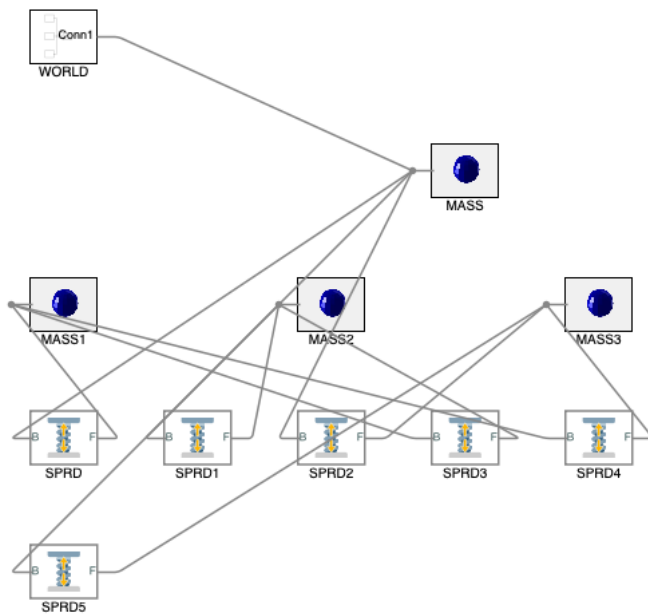

2 Create six springs between the masses

```
smbCreateSpring('MASS','MASS1');
smbCreateSpring('MASS','MASS2');
smbCreateSpring('MASS','MASS3');
smbCreateSpring('MASS1','MASS2');
smbCreateSpring('MASS1','MASS3');
smbCreateSpring('MASS2','MASS3');
```

3. Connect the mass - spring - damping system to the world coordinate system

```
smbAddLine( 'WORLD/RConn1', 'MASS/LConn1');
ID=smbDrawNow;
```
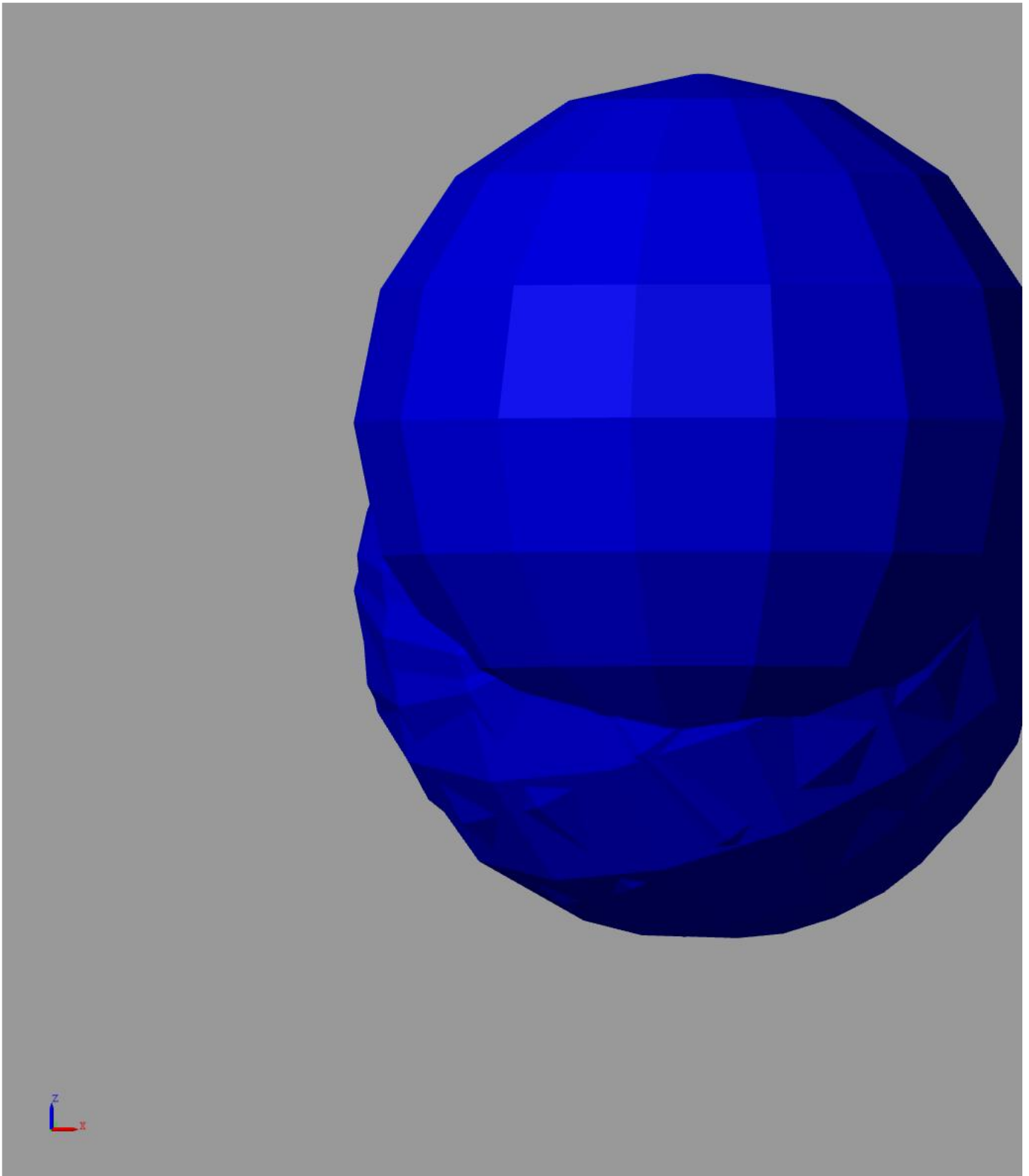
4. Show the Simulation

6. Create a Video of the Linkage Simulation

```
[I1,vname]=smbVideoSimulation (4);    % Simulate for 1 second
IT=imageVideoTitle(vname,{'SG-Lib Tutorial #29','Mass-Spring-Nets','Tim C. Lueth','$date'},'',[0 4]);
IE=imageVideoEndtitle(vname);
videoWriteClipMovie(smbFilename('SG-Lib Tutorial #29-Mass-Spring-Nets.avi'),IT,2,ID,1,vname,IE,1);
imshow(I1);
```

```
.........Creating a new video file (NO SOUND/2016b): '/Users/timlueth/Desktop/tmp_SG_LIB_EXP_29/SG-Lib Tutorial #29-Mass-Spring-Nets.avi'
5% 10% 15% 20% 25% 30% 35% 40% 45% 50% 55% 60% 65% 70% 75% 80% 85% 90% 95% 100%
```

Final Remarks

```
close all
VLFLlicense
```

```
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 07:52:16!
```

```
Executed 03-Oct-2023 07:52:18 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
=================================================================================================
```

Published with MATLAB® R2023a