Tutorial 63: Generation of STL archives through the analysis of assemblies

2021-02-25: Tim C. Lueth, Professor at Technische Universität München, Germany (URL: http://www.SG-Lib.org) - Last Change: 2022-02-26

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: Creation of Kinematic Chains and Robot Structures
- Tutorial 36: Creating a Patient-Individual Arm-Skin Protector-Shell
- Tutorial 37: Dimensioning of STL Files and Surface Data
- Tutorial 38: Some more solid geometry modelling function
- Tutorial 39: HEBO Modules robot design
- Tutorial 40: JACO Robot Simulation and Control
- Tutorial 41: Inserting Blades, Cuts and Joints into Solid Geometries
- Tutorial 42: Performing FEM Stress and Displacement Analysis and Structural Optimization of Solids
- Tutorial 43: Performing FEM Structural Optimization (CAO) and Topological Optimization (SKO) of Solids
- Tutorial 44: Creation of solids and kinematics from 3D curves and transformation matrices
- Tutorial 45: Creation of Solids using the SG-Coder - SGofCPLcommand
- Tutorial 46: Creating Fischertechnik compatible gear boxes using SGofCPLcommand
- Tutorial 47: Create a Solid by two arbitrary CPLs and a distance
- Tutorial 48: Gear Pairings by Yannick Krieger
- Tutorial 49: Generation of non circular gear pairs by Yannick Krieger/Sebastian Baumgartner
- Tutorial 50: CVLof2CPLzcorrelate and SGof2CPLzcorrelate
- Tutorial 51: Creating Parallel Tasks for batch processing
- Tutorial 52: CPL Buffers and cw/ccw Orientation
- Tutorial 53: SKOL - Soft Kill Option for Large Displacement by Yilun Sun

Motivation for this tutorial: (Originally SolidGeometry 5.1 required)

This tutorial shows how to create an STL assembly archive automatically from STl geometries. SGwriteSTLarchive

```
% clear JACO

loadweb JACO_robot.mat

SGwriteSTLarchive(JACO,'surfaces')
```

```
loadweb: Access path to changed from "www.mimed.mw.tum.de" to "www.mw.tum.de/mimed/" in 2020 Aug.
loadweb: Access path to changed from "www.mw.tum.de/mimed/" to "www.mec.ed.tum.de/mimed/" in 2021 Nov.
Downloading "https://www.mec.ed.tum.de/fileadmin/w00cbp/mimed/Matlab_Toolboxes/JACO_robot.mat" into: /Volumes/LUETH-WIN/WIN AIM Matlab Libraries/SolidG
ans =
    '/Volumes/LUETH-WIN/WIN AIM Matlab Libraries/SolidGeometry-Code/downloaded_JACO_robot.mat'
SGwriteSTLarchive: Number of processed surfaces: 37
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=173559.4[82.5x82.5x25.5]V=713F=1430_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 1430
Number of vertices: 713

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=173559.4[82.5x82.5x25.5]V=713F=1430_00001.stl!
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=673818.8[99.0x82.5x82.5]V=7255F=14524_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=439003.1[82.5x82.5x64.5]V=1798F=3570_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 3570
Number of vertices: 1791

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=439003.1[82.5x82.5x64.5]V=1798F=3570_00001.stl!
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=9520.0[23.8x20.0x20.0]V=2214F=4424_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=9520.0[23.8x20.0x20.0]V=1036F=2068_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=3027.7[17.0x13.7x13.0]V=1980F=3996_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=6364.8[20.8x20.4x15.0]V=126F=248_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 248
Number of vertices: 126

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=6364.8[20.8x20.4x15.0]V=126F=248_00001.stl!
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=31.5[3.5x3.0x3.0]V=108F=212_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=100600.9[100.3x100.3x10.0]V=1120F=2186_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 2186
Number of vertices: 1120

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=100600.9[100.3x100.3x10.0]V=1120F=2186_00001.stl!
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=93508.9[96.7x96.7x10.0]V=1140F=2312_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 2312
Number of vertices: 1140
```

```
Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=93508.9[96.7x96.7x10.0]V=1140F=2312_00001.stl!
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=52133.8[86.3x86.3x7.0]V=356F=712_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 712
Number of vertices: 356

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=52133.8[86.3x86.3x7.0]V=356F=712_00001.stl!
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=224175.5[86.3x86.3x30.1]V=621F=1428_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 1428
Number of vertices: 621

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=224175.5[86.3x86.3x30.1]V=621F=1428_00001.stl!
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=150443.3[86.3x86.3x20.2]V=400F=796_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 796
Number of vertices: 400

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=150443.3[86.3x86.3x20.2]V=400F=796_00001.stl!
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=104889.3[74.3x74.3x19.0]V=1058F=2148_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 2148
Number of vertices: 1058

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=104889.3[74.3x74.3x19.0]V=1058F=2148_00001.stl!
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=28152.1[47.0x29.8x20.1]V=150F=308_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=5602.4[47.0x29.8x4.0]V=8F=12_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=313.6[10.0x5.6x5.6]V=74F=148_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=0.0[82.5x82.5x0.0]V=117F=117_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 117
Number of vertices: 117

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=0.0[82.5x82.5x0.0]V=117F=117_00001.stl!
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=173559.4[82.5x82.5x25.5]V=713F=1313_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 1313
Number of vertices: 713

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=173559.4[82.5x82.5x25.5]V=713F=1313_00001.stl!
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=1032282.1[151.3x82.7x82.5]V=10012F=19946_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 19946
Number of vertices: 9973

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=1032282.1[151.3x82.7x82.5]V=10012F=19946_00001.stl!
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=6833231.9[405.4x335.1x50.3]V=8738F=17480_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 17480
Number of vertices: 8738

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=6833231.9[405.4x335.1x50.3]V=8738F=17480_00001.stl!
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=1254156.8[241.3x82.5x63.0]V=7938F=15804_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 15804
Number of vertices: 7902

Solid is identical with /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=1254156.8[241.3x82.5x63.0]V=7938F=15804_00001.stl!
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=71442.0[63.0x63.0x18.0]V=726F=1438_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=71442.0[63.0x63.0x18.0]V=722F=1320_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
SGwriteSTLarchive: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=0.0[63.0x63.0x0.0]V=118F=118_00002
publishSGPDF:<a href = "matlab: openbydoubleclick ('/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib')">/Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/</a><a hre
LOADING BINARY STL-File: /Users/timlueth/Desktop/STL_ARCHIVE_SG_Lib/VOL=470331.6[80.3x78.2x74.9]V=5101F=10202_00001.stl
Binary Header: COLOR=RGBA,MATERIAL=AAAABBBBCCCCDDDD;SOLID "/Users/timlueth/Desktop/STL_ARCHIVE_
Color of solid defined as: "k"
Alpha of solid defined as: 65.00
Number of facets: 10202
```