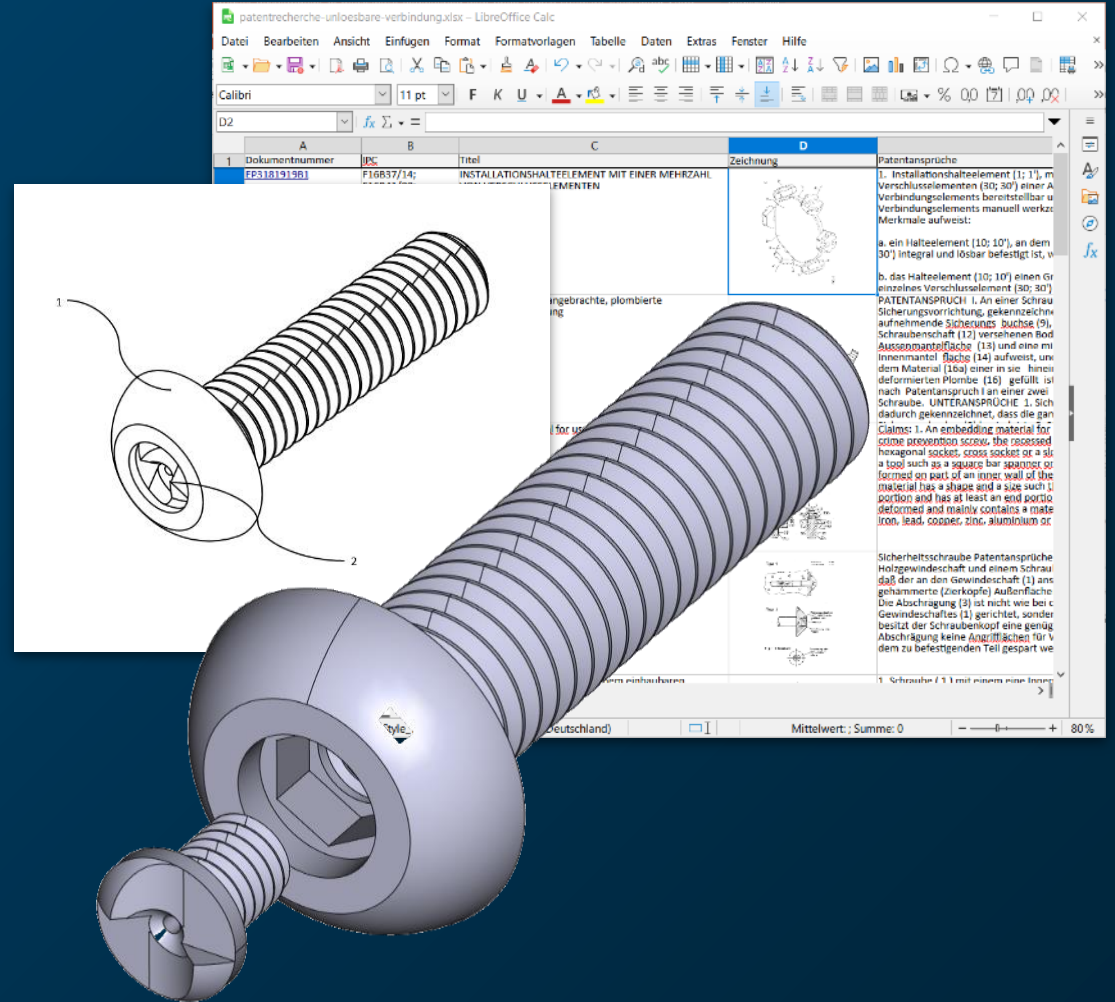


Product development with FreeCAD

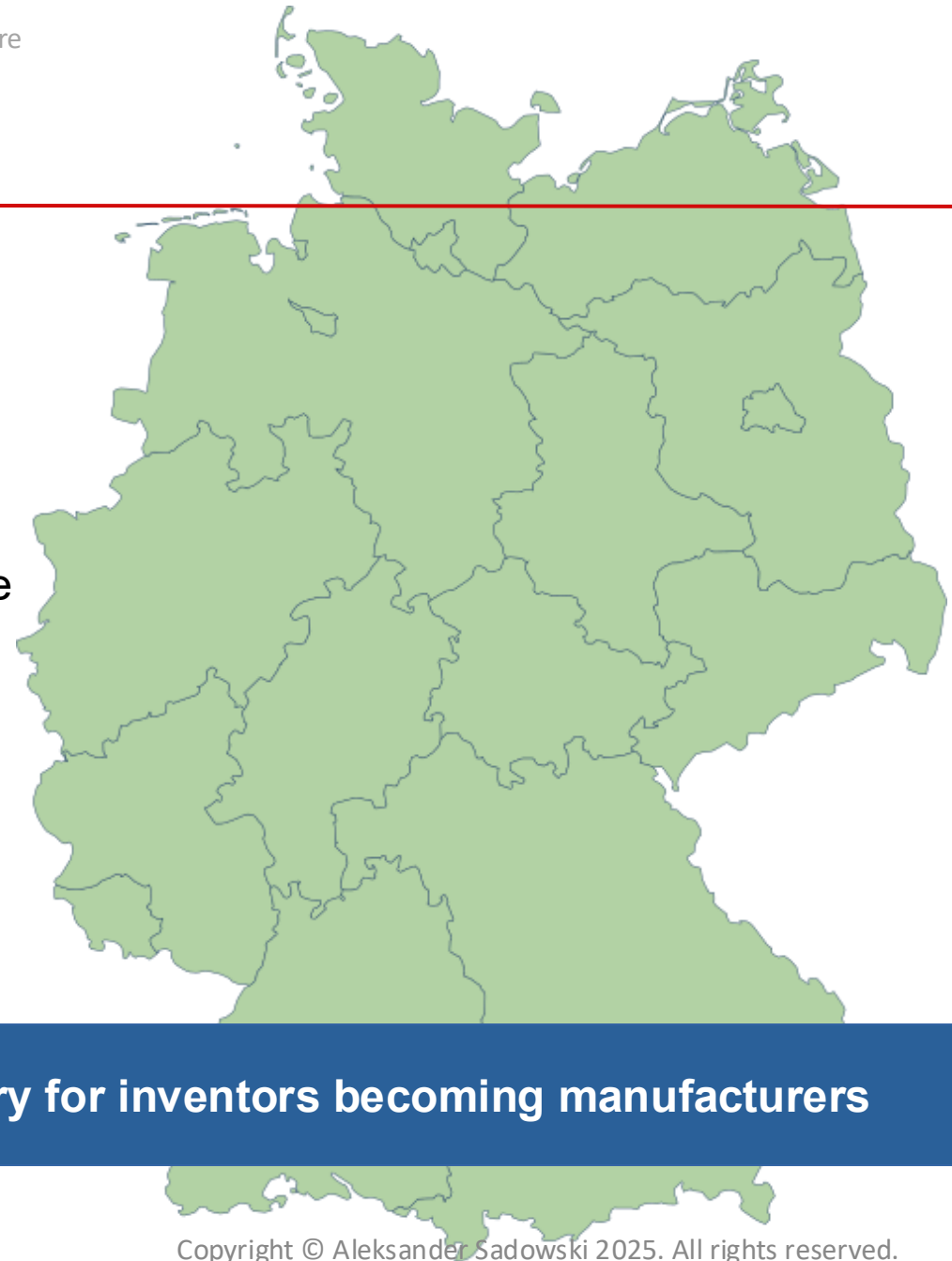
Guide to the product development process using open-source software

Aleksander Sadowski



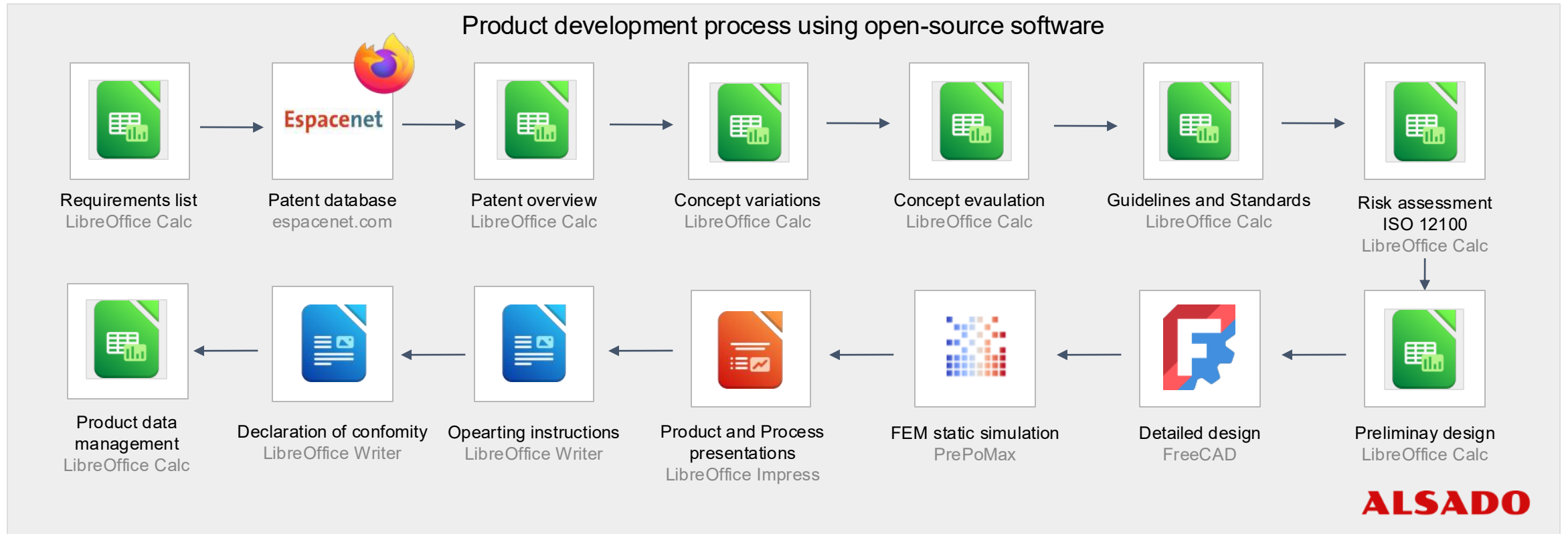
Manufacturing in Germany

- Industry on downwards trends
- Affecting overall prosperity across entire nation
- China is taking over High-tech
- Boost inventions and their implementation
- Entrepreneurs need lower barrier to entry and more stability



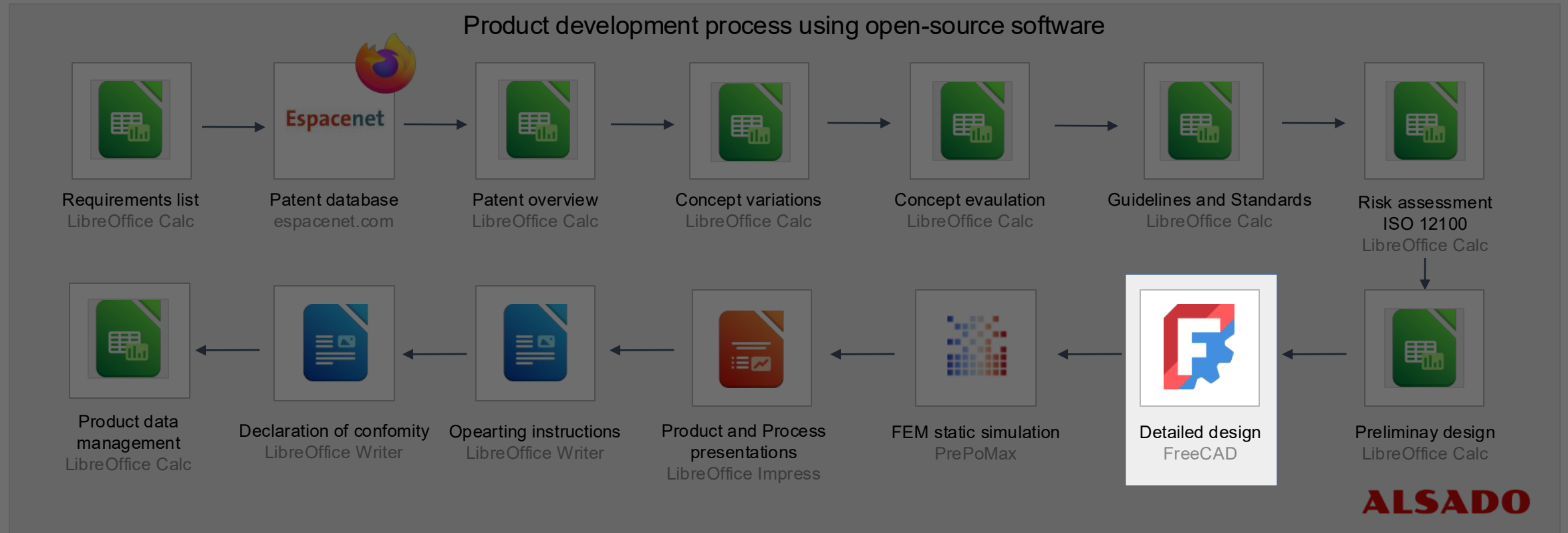
=> Open-source software lowers the barrier to entry for inventors becoming manufacturers

Overview of the Product development process using open-source software

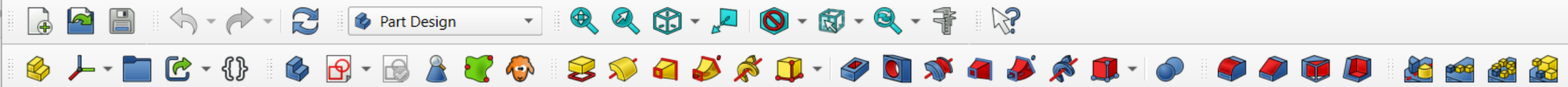


=> Product development can be fully implemented using open-source software

Overview of the Product development process using open-source software



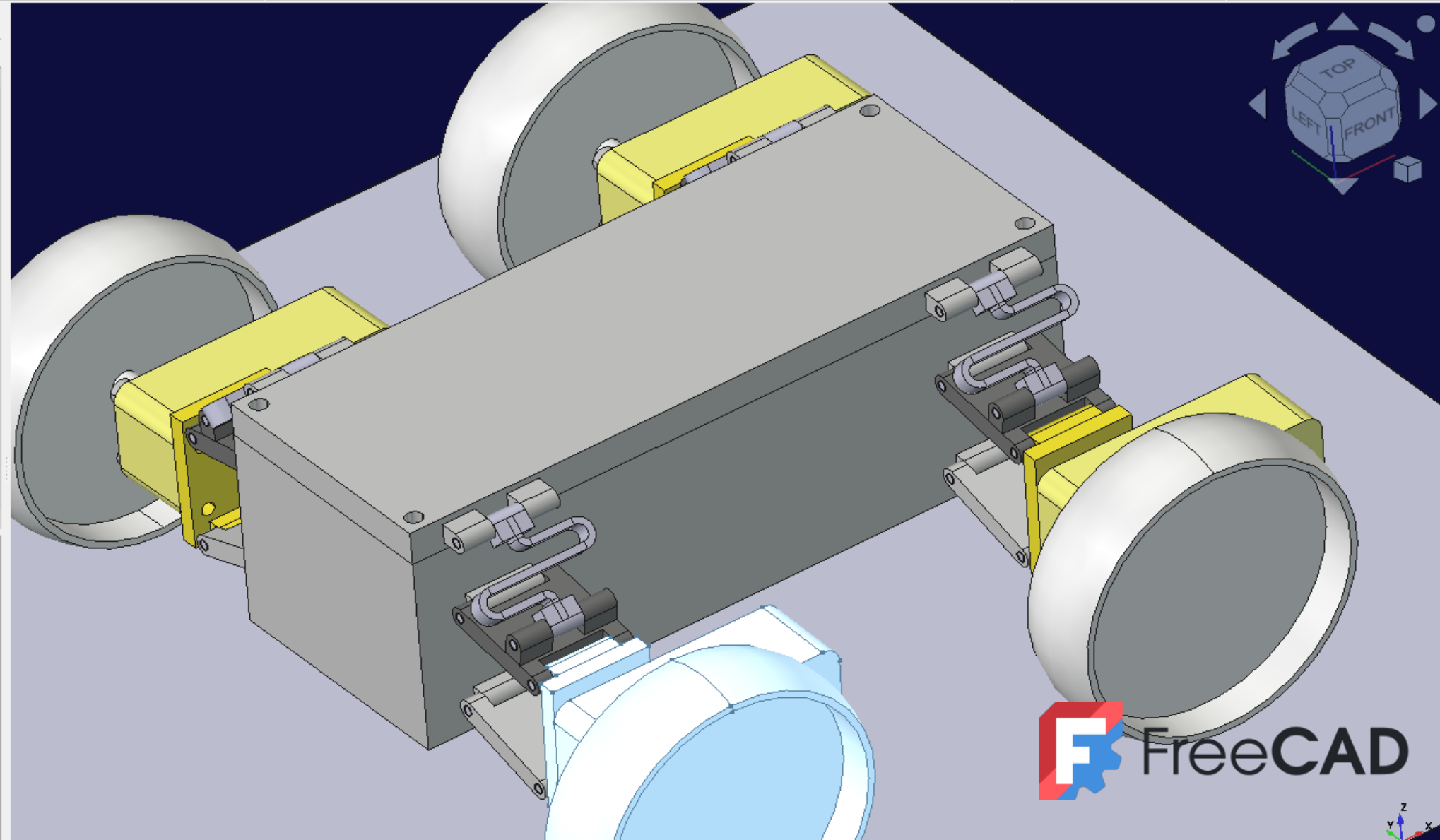
=> Product development can be fully implemented using open-source software



Model Tasks

Model

- antrieb-links-new-1_0_a2p
 - gehaeuse-unten_001
 - gahaeuse-oben_001
 - querlenker-oben_001
 - querlenker-oben_002
 - querlenker-oben_003
 - querlenker-oben_004
 - feder-v2_001
 - feder-v2_002
 - feder-v2_003
 - feder-v2_004
 - querlenker-unten_001
 - querlenker-unten_002
 - querlenker-unten_003
 - querlenker-unten_004
 - antrieb-links_001
 - antrieb-links_002
 - antrieb-rechts_001



Base

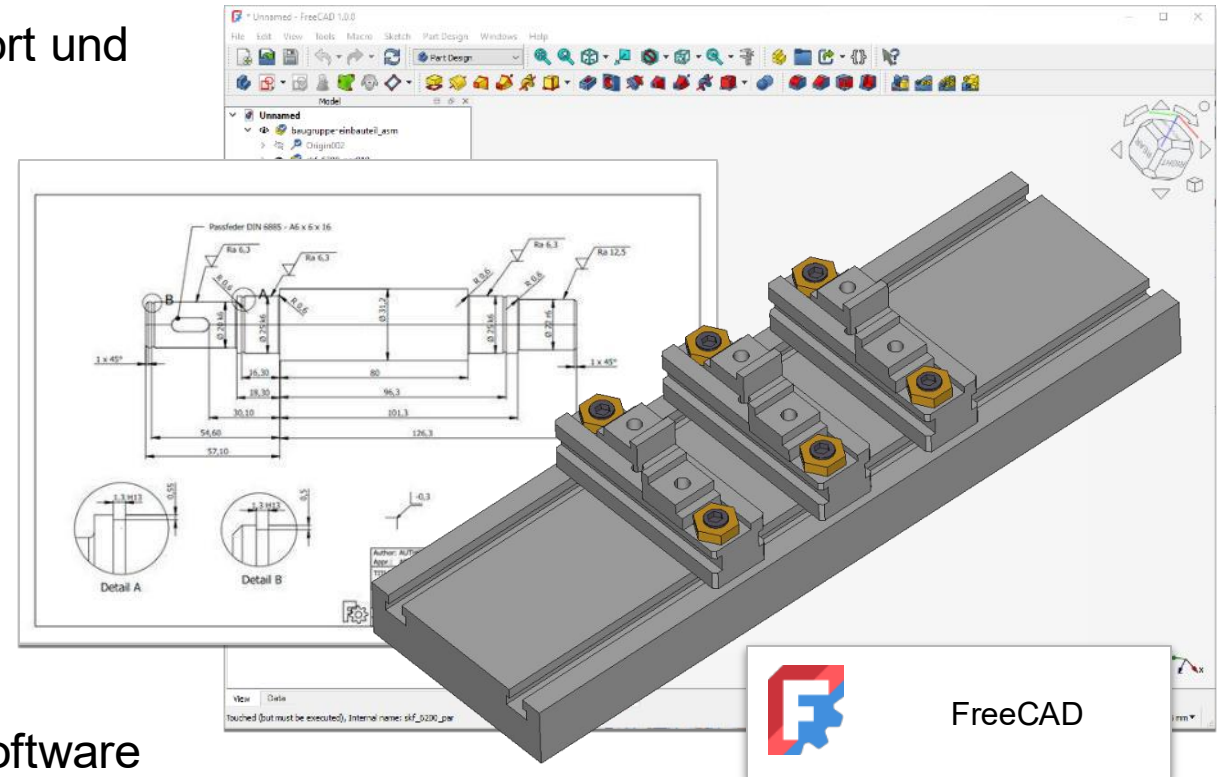
Placement	[[0,01 0,01 -1,0
Label	antrieb-links_0

import Part

a2p_Version	0.4.68
fixed Position	<input type="checkbox"/> No
local Source Object	
mux Info	[]
object Type	a2pPart
source File	.\antrieb-links.f

Detailed design in FreeCAD

- 3D-CAD-software with universal Interface: Import und Export STEP, DXF, PDF
- Modular framework:
 - Part Design (parts)
 - A2Plus (assemblies)
 - TechDraw (technical drawings)
- Python-API: Intuitively understand scripting and automate tasks
- Community: Wiki, Forum and social media
- Over 20 million downloads as a Desktop GUI software



=> FreeCAD is a complete 3D CAD software

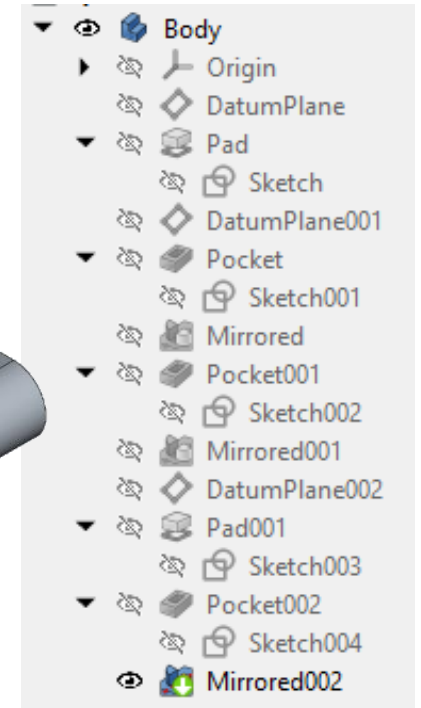
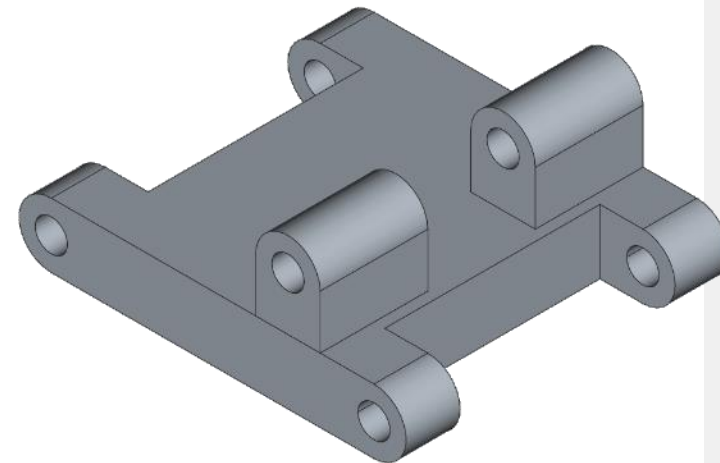
Part Design: Creating individual parts

- Each document represents one part (*.FCStd)
- One body within document (except parts that require booleans)
- Body includes Origin (planes and axes)

Part Design Workflow:

1. Select plane or create a new datum plane
2. Create sketch on that plane
3. Create 3D feature from sketch (sketch gets consumed by feature)

- First additive then subtractive features
- Topology dependent features at the end

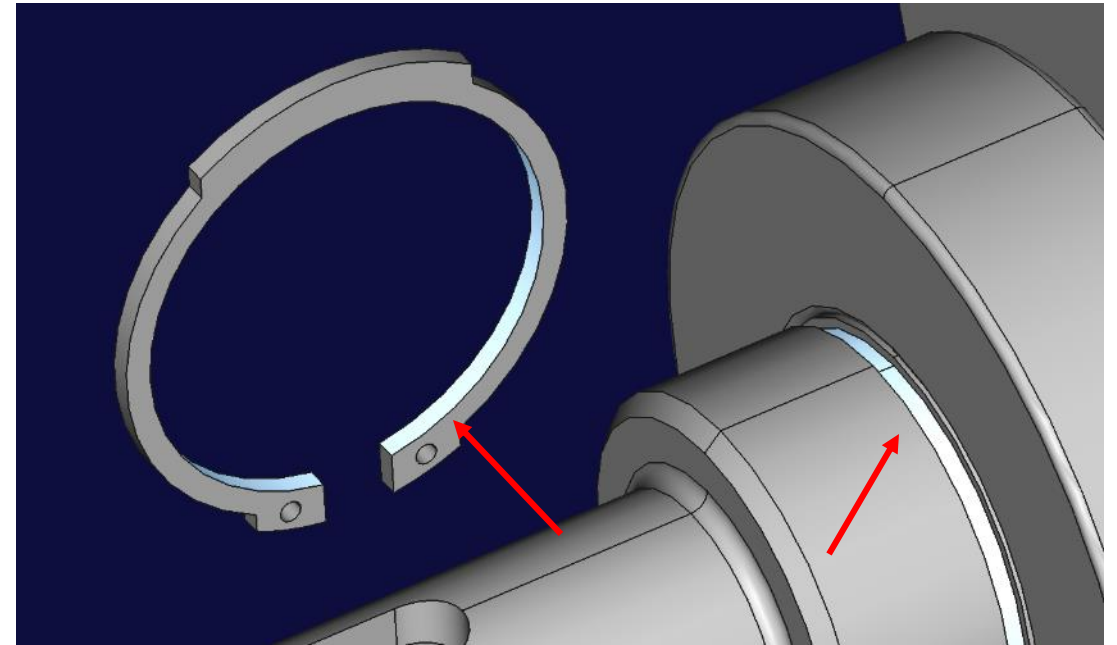


Body object of upper wishbone part in the document tree

=> Creating parts in FreeCAD is similar to most CAD software

A2plus: Creating assemblies using constraints

- Create each assembly as separate FreeCAD document (*.FCStd)
- Import instances of parts from external FreeCAD document (*.FCStd)
- Constrain faces and axes of parts (e.g. Plane coincident or Axis coincident)
- Temporarily move parts, to get access to selected topology elements
- Create a multi-level assembly hierarchy with subassemblies



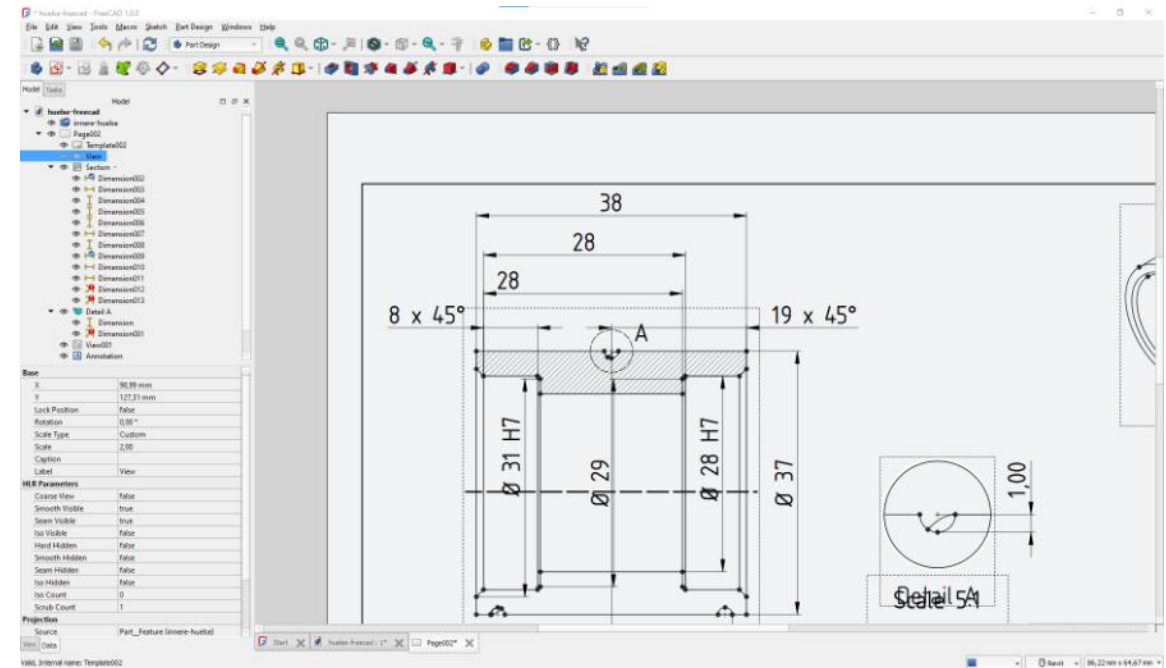
Selecting two cylindrical faces of the snap ring and groove to define a Axis coincident constraint

=> Creating assemblies in FreeCAD is similar to most CAD software



TechDraw: Creating technical drawings for manufacturing

- Create drawing page with integrated and editable page template (*.SVG)
- Rotate part body to its main view in 3D view, select it and create a projection group on the page
- Add dimensions (e.g. distance, diameter or radius) and tolerances (e.g. +/- per dimension or as page annotation)
- Add edge and surface annotations (e.g. roughness or edge break)
- Define material, treatment and more
- Export as PDF document for manufacturing

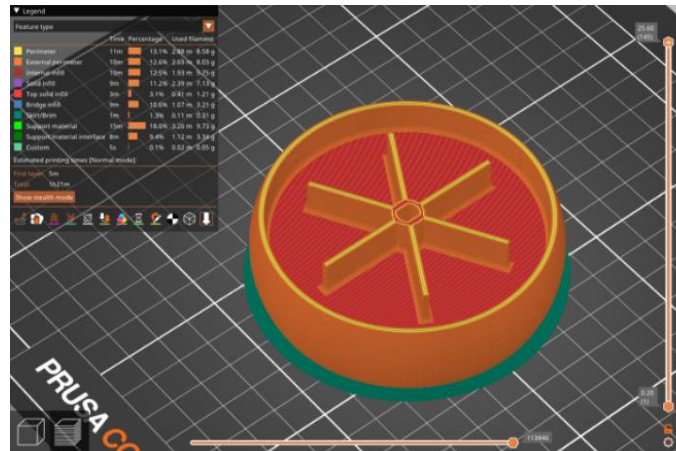


=> Derive technical drawings from 3D CAD models and get your design manufactured

PrusaSlicer: Prepare your parts for 3D printing

- Export part bodies from FreeCAD as 3MF
- Import parts into PrusaSlicer and arrange on build plate
- Set printing settings and click on slice
- Save the gcode and transfer it to your 3D printer

**PRUSA
RESEARCH**
by JOSEF PRUSA



=> Quickly manufacture the first prototype of your design with 3D printing

FreeCAD supports for industry standard SpaceMouse



=> FreeCAD is ready for professional environments

FreeCAD Beginner's Handbook

Turn your idea from sketch to 3D-printable prototype



ALSADO



Aleksander Sadowski

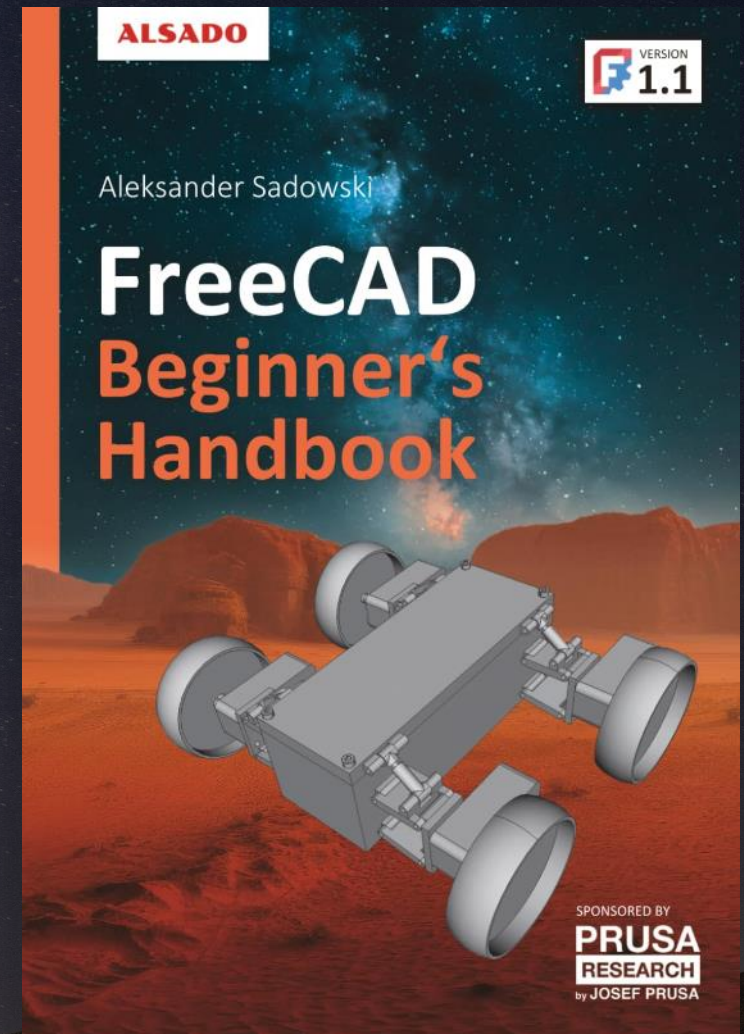
Liebfrauenstraße 31

53757 Sankt Augustin

Mobil +49 (0) 1578 965 67 67

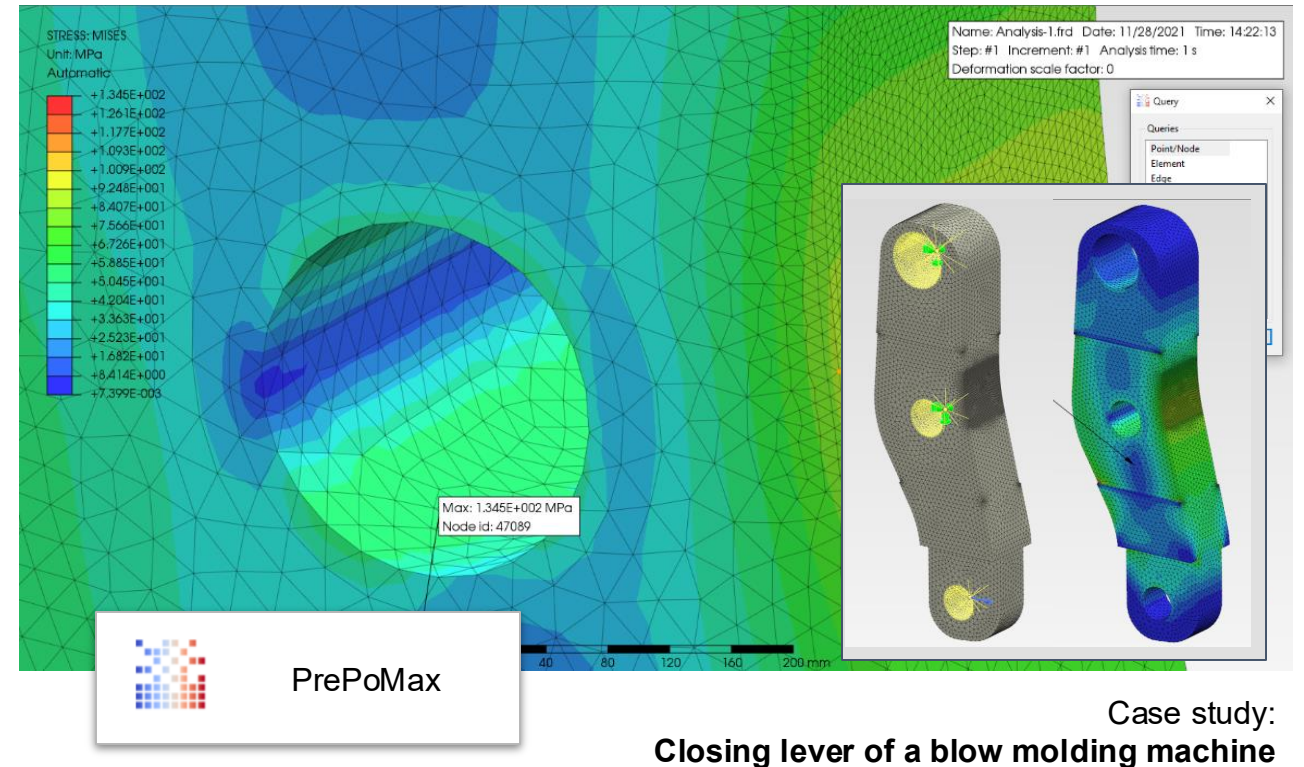
E-Mail aleksander.sadowski@alsado.de

Web www.alsado.de



Simulation with Finite-Element-Method

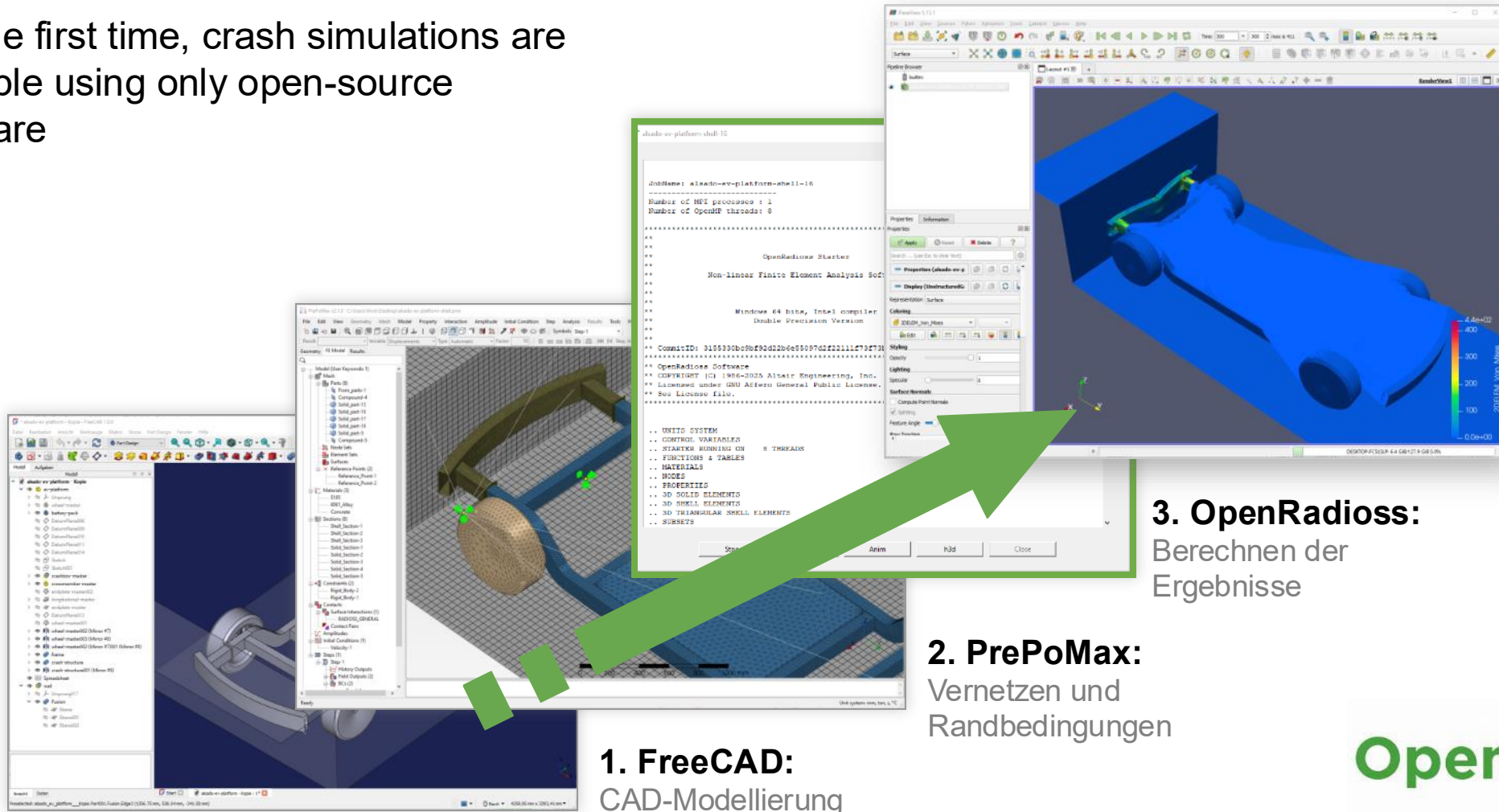
- PrePoMax GUI and workflow similar to Abaqus
- PrePoMax with Calculix solver for static analysis
- PrePoMax with OpenRadioss solver for dynamic analysis



=> PrePoMax is similar to Abaqus and can be used as a pre-processor for OpenRadioss

Dynamic simulations with open-source software

For the first time, crash simulations are possible using only open-source software



1. FreeCAD:
CAD-Modellierung

2. PrePoMax:
Vernetzen und
Randbedingungen

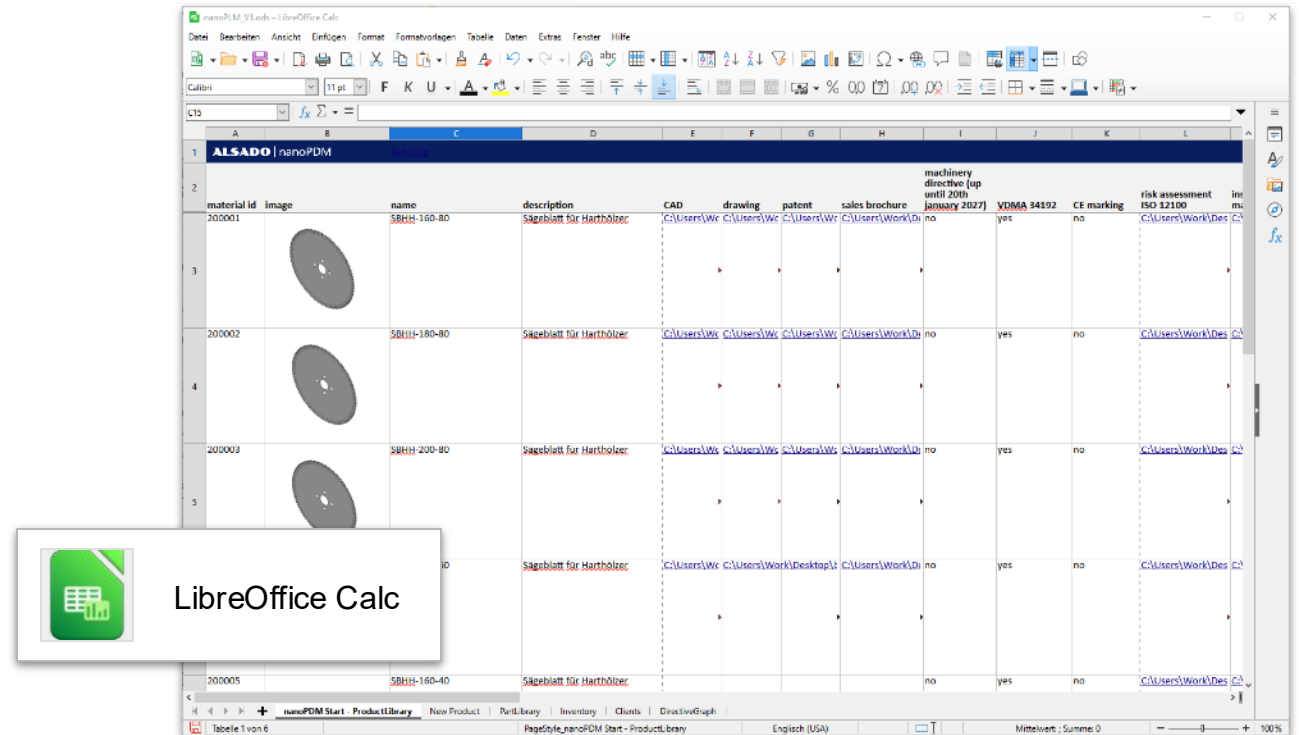
3. OpenRadioss:
Berechnen der
Ergebnisse

4. ParaView:
Visualisierung der
Ergebnisse

OpenRadioss™

Product data management using simple tools

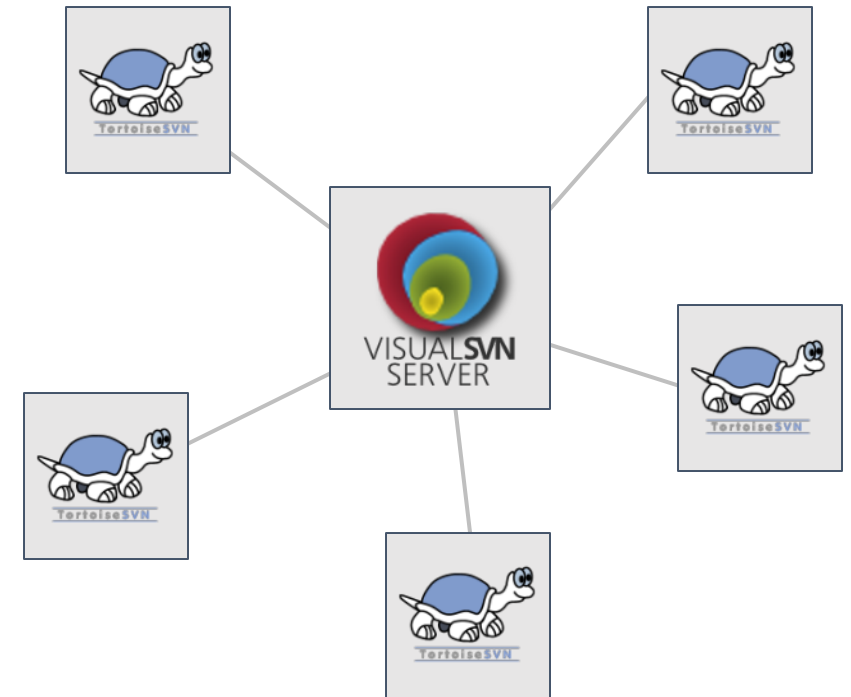
- Manage all your parts and assemblies in a centralized spreadsheet with all associated files (drawings, legal documents, patents)
- Easily accessible for non-engineers
- Assign clients to serial numbers



=> Getting an overview of all your parts, products and associated files

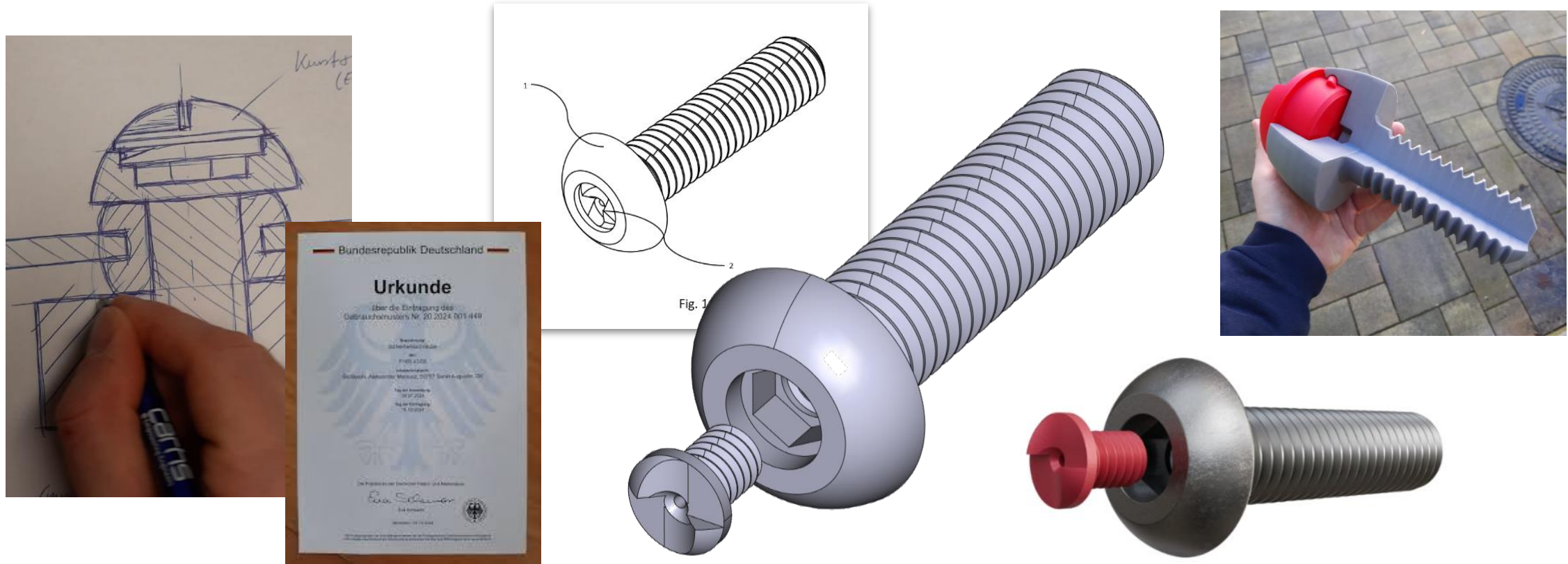
Create an infrastructure for your team

- Setup versioning system for product data without programming skills (VisualSVN + TortoiseSVN)
- Let your team collaborate and manage their roles
- Prevent file duplicates
- Centralized server in your organisation with redundancy and a battery backup
- Back up data in regular time intervals and store it in a different location



=> Secure your product data and enable collaboratin in a team

Invention: Security (tamper-resistant) screw



=> Validating the open-source workflow for product development


OpenPartsLibrary
mk 900
Parts BOMs English (US)

Parts

Supplier: All suppliers | Min price (EUR): | Max price (EUR):

183 parts were found.

	Part number	Name ↑	Estimated unit price	Supplier
	000111	Aluminum profile mk 2060.05 90...	190.00 EUR	Maschiner
	000129	Aluminum profile mk 2040.01 90...	100.00 EUR	Maschiner
	000142	mk Winkel K100 82.60.0902	15.00 EUR	Maschiner
	000112	Aluminum profile mk 2060.05 10...	210.00 EUR	Maschiner
	000130	Aluminum profile mk 2040.01 10...	110.00 EUR	Maschiner
	000113	Aluminum profile mk 2060.05 11...	230.00 EUR	Maschiner
	000131	Aluminum profile mk 2040.01 11...	120.00 EUR	Maschiner
	000114	Aluminum profile mk 2060.05 12...	250.00 EUR	Maschiner
	000132	Aluminum profile mk 2040.01 12...	130.00 EUR	Maschiner
	000115	Aluminum profile mk 2060.05 13...	270.00 EUR	Maschiner
	000133	Aluminum profile mk 2040.01 13...	140.00 EUR	Maschiner
	000116	Aluminum profile mk 2060.05 14...	290.00 EUR	Maschiner
	000134	Aluminum profile mk 2040.01 14...	150.00 EUR	Maschiner
	000117	Aluminum profile mk 2060.05 15...	310.00 EUR	Maschiner



Aluminum profile mk 2060.05 1000 mm

My Bill of Materials

Aluminum profile mk 2060.05 1300 mm
Part number: 000115
Quantity: 8
Estimated unit price: 270.00 EUR

Aluminum profile mk 2060.05 1200 mm
Part number: 000114
Quantity: 5
Estimated unit price: 250.00 EUR

Aluminum profile mk 2060.05 1100 mm
Part number: 000113
Quantity: 2
Estimated unit price: 230.00 EUR

Aluminum profile mk 2060.05 1000 mm
Part number: 000112
Quantity: 2
Estimated unit price: 210.00 EUR

Aluminum profile mk 2060.05 900 mm
Part number: 000111
Quantity: 4
Estimated unit price: 190.00 EUR

Estimated total: 5050.00 EUR

Download all

Copyright (C) 2024 - 2025. OpenPartsLibrary by www.alsado.de

The screenshot displays the OpenPartsLibrary BOM Builder interface. The main workspace shows a hierarchical tree of components. On the left, a 'My Bill of Materials' panel shows a total estimated price of 2136.00 EUR. The central area contains several component cards, each with a 'Select' tab and a 'New' tab. The components include:

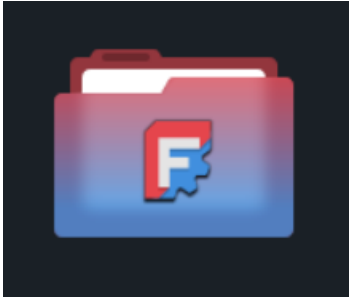
- 000111 - Aluminum profile mk 2060.0... (Quantity: 2, Estimated price: 380.00 EUR)
- 000110 - Aluminum profile mk 2060.0... (Quantity: 1, Estimated price: 170.00 EUR)
- BOM000006 - Mounting plate (Quantity: 1, Estimated price: 150.00 EUR)
- 000121 - Aluminum profile mk 2040.0... (Quantity: 1, Estimated price: 20.00 EUR)
- 000130 - Aluminum profile mk 2040.0... (Quantity: 1, Estimated price: 110.00 EUR)
- 000121 - Aluminum profile mk 2040.0... (Quantity: 1, Estimated price: 20.00 EUR)
- 000088 - Linear rail SBR12 1000 mm (Quantity: 2, Estimated price: 44.00 EUR)
- BOM000005 - Machine (Quantity: 1, Estimated price: 274.00 EUR)
- 000081 - Linear rail SBR12 200 mm (Quantity: 2, Estimated price: 30.00 EUR)
- 000121 - Aluminum profile mk 2040.0... (Quantity: 1, Estimated price: 30.00 EUR)

On the right, a 'Library' panel shows a search bar and a list of 50 items found. The list includes:

- BOM000005 - Machine (224.00 EUR)
- BOM000006 - Mounting plate (150.00 EUR)
- 234234 - asdasd (260.00 EUR)
- BOM000004 - asdasd (297.00 EUR)
- BOM000007 - asdasd (150.00 EUR)
- BOM000002 - bigger structure (3230.00 EUR)
- BOM000003 - bigger structure (copy) (3880.00 EUR)
- BOM000001 - structure

At the bottom left, a copyright notice reads: Copyright (C) 2024 - 2025, OpenPartsLibrary by www.alsado.de

FreeCAD
Package
(assembly)



Open-Source PLM

Kontakt



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Inhaber

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Web www.alsado.de



Mission: Deutschen Maschinenbau mittels Open-Source-Software wieder auf Vordermann bringen!