

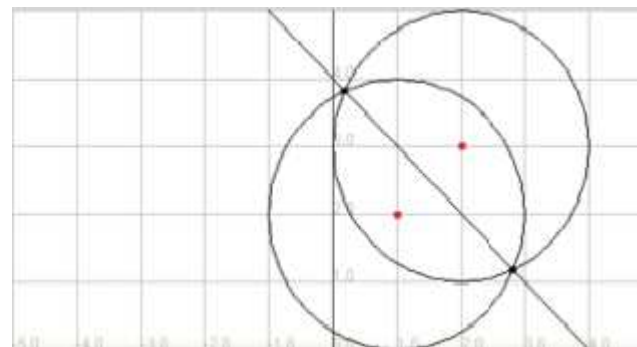
# Geometric Algebra Computing Tools



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**Dr.-Ing. Dietmar Hildenbrand**  
Technische Universität Darmstadt



# Geometric Algebra ComputingTools

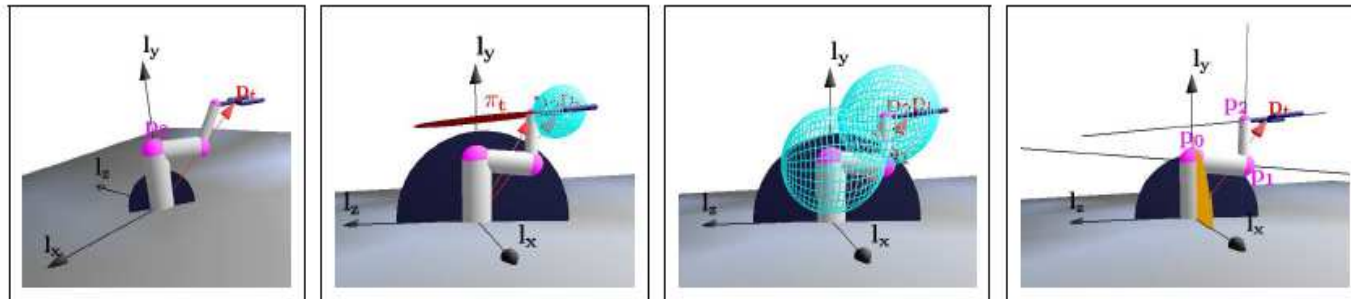


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- GAALOP



- CLUCalc



- Python      new infrastructure (e.g. for Mathematica)

# GAALOP



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- Software to
  - visualize (2D/3D) Geometric Algebra
  - compute with Geometric Algebra (of arbitrary dimension/signature)
  - generate optimized source code from Geometric Algebra
- GAALOP (**free download** from [www.GAALOP.de](http://www.GAALOP.de))



**GAALOP** [WWW.GAALOP.DE](http://WWW.GAALOP.DE)  
GEOMETRIC ALGEBRA ALGORITHMS OPTIMIZER

Startseite Documentation Download About | Imprint Geometric Algebra Computing lecture Dietmar Hildenbrand

**Welcome to the GAALOP website!**

- Requirement: **Java**

# GAALOP



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[www.gaalop.de/download/](http://www.gaalop.de/download/)

There are currently two versions of GAALOP. A GUI based standalone version, that allows for quick and easy experiments and a more development-focused variant named GAALOP Precompiler.

## GAALOP

In the new versions of GAALOP, Maple is no longer required. We are introducing an advanced new method named Table Based Approach. This method can optionally be enhanced with Maxima support. Maxima is a powerful symbolic computing engine, available at <http://maxima.sourceforge.net> as open source.

[Find the sources on GitHub](#)

[download GAALOP](#)

Once you installed it, start it with „java -jar starter-1.0.0.jar“ from the commandline.

# GAALOP Installation



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We recommend also to install Maxima [53] in order to be able to use the complete optimization potential of GAALOP. Fig. 3.1 shows how GAALOP

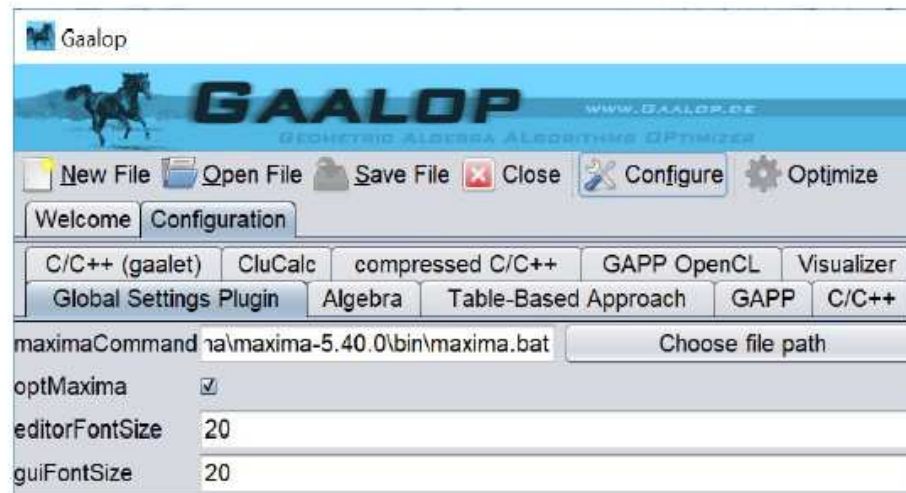
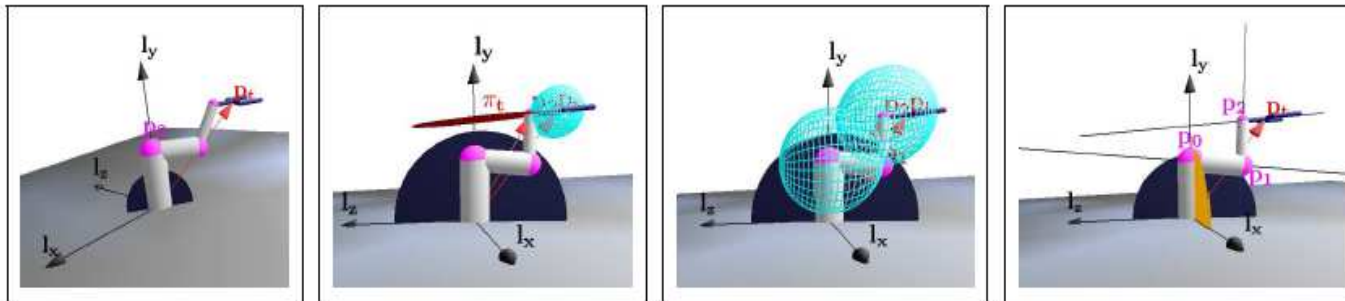


FIGURE 3.1 Global Setting Plugin for the configuration of Maxima (as well as font sizes).

has to be configured for the use of Maxima<sup>1</sup>. In the Global Setting Plugin the path of the file *maxima.bat* of the Maxima installation has to be chosen and *optMaxima* has to be activated.

[53] Maxima Development Team. Maxima, a computer algebra system. version 5.18.1. Available at <http://maxima.sourceforge.net/>, 2017.

- Visual, interactive development

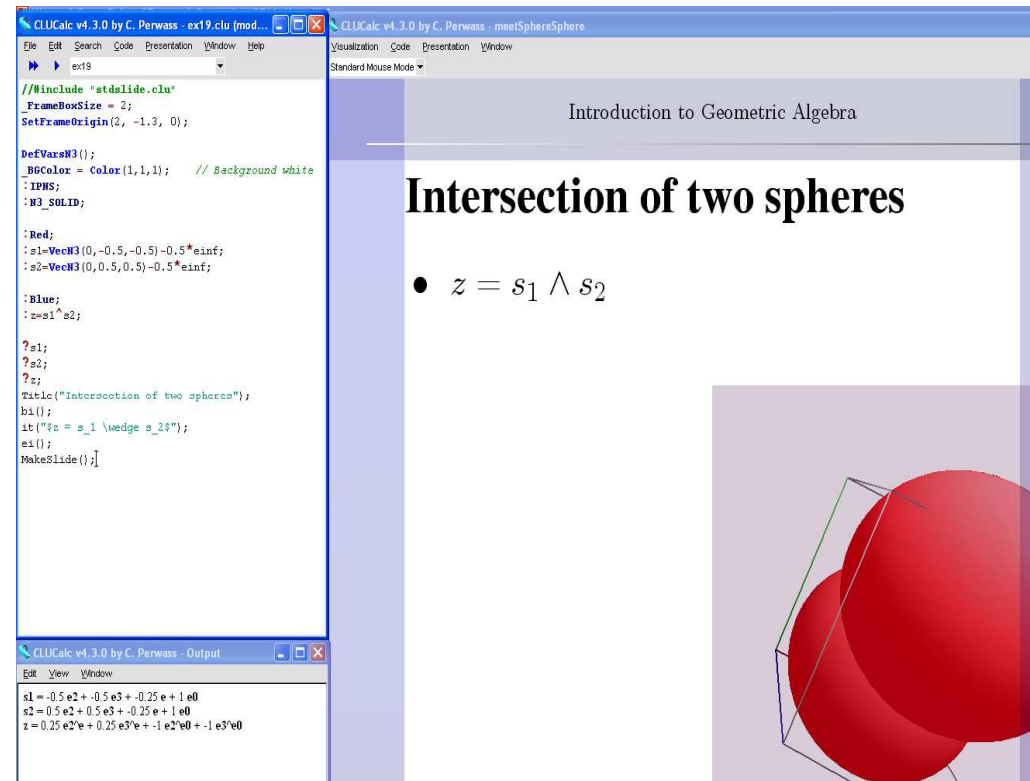


- Input language of GAALOP





- Software package in order to
  - Compute with Geometric Algebra
  - Visualize the results
- Consisting of
  - Editor window
  - Visualisation window
  - Output window
- Free download



The screenshot displays the CLUCalc v4.3.0 interface. The main window is titled "Introduction to Geometric Algebra" and shows a slide titled "Intersection of two spheres" with the equation  $z = s_1 \wedge s_2$ . To the right of the slide is a 3D visualization of two overlapping red spheres. The left pane shows the source code for the slide, and the bottom pane shows the output of the computation.

```
//include "stdslide.clu"  
_FrameBoxSize = 2;  
SetFrameOrigin(2, -1.3, 0);  
  
DefVarsN3();  
_BgColor = Color(1,1,1); // Background white  
_IPMS;  
_W3_SOLID;  
  
_Red;  
s1=VecN3(0,-0.5,-0.5)-0.5*einf;  
s2=VecN3(0,0.5,0.5)-0.5*einf;  
  
_Blue;  
z=s1^s2;  
  
?s1;  
?s2;  
?z;  
Title("Intersection of two spheres");  
h1();  
t1("z = s_1 \wedge s_2");  
e1();  
MakeSlide();]
```

Output:  
s1 = -0.5 e2 + -0.5 e3 + 0.25 e + 1 e0  
s2 = 0.5 e2 + 0.5 e3 + -0.25 e + 1 e0  
z = 0.25 e2^e + 0.25 e3^e + -1 e2^e0 + -1 e3^e0

# CLUCalc



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- Free download via [www.cluviz.de](http://www.cluviz.de)

← → ↻ ⓘ Nicht sicher | cluviz.de

Apps Google Earth



**DOWNLOAD**

[Download CluViz 7.0.26](#)

[Download CluCalc 4.3.2](#)



# Additional properties of CLUCalc

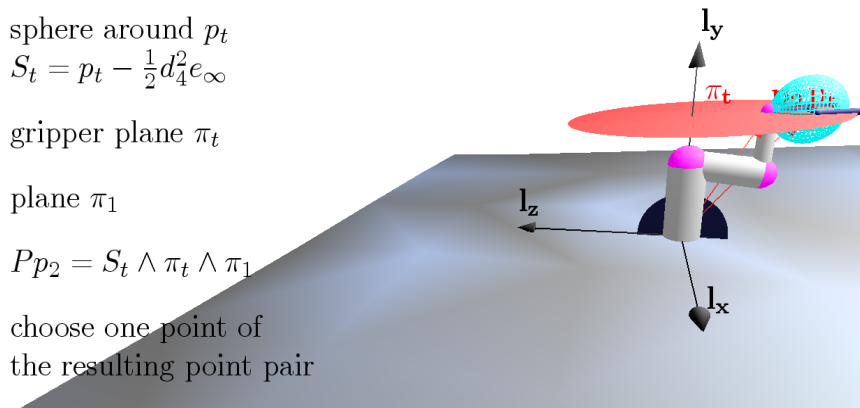


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- Direct test of algorithms
- Latex annotation for publications
- Support for presentations
- ...
- Downloads
  - Latex for Windows:  
[www.miktex.org](http://www.miktex.org)
  - GNU Ghostscript v7.07  
AFPL Ghostscript v8.13  
[www.ghostscript.com](http://www.ghostscript.com)

## Step 2 : compute $p_2$

- sphere around  $p_t$   
 $S_t = p_t - \frac{1}{2}d_4^2 e_\infty$
- gripper plane  $\pi_t$
- plane  $\pi_1$
- $Pp_2 = S_t \wedge \pi_t \wedge \pi_1$
- choose one point of the resulting point pair



# Python



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- Popular
- Widely used for many applications (including artificial intelligence)
- Many operating systems
- Good infrastructure of tools and libraries
- Free download
  - Command line interface
  - IDLE (Integrated DeveLopment Environment)

# Python



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Python Software Foundation [US] | <https://www.python.org/downloads/>

Google Earth

The screenshot shows the Python.org website with a dark blue header. The top navigation bar includes links for Python, PSF, Docs, PyPI, Jobs, and Commu. Below this is the Python logo, a yellow 'Donate' button, a search bar with a magnifying glass icon and a 'GO' button, and a secondary navigation bar with links for About, Downloads, Documentation, Community, Success Stories, News, and Events. The main content area features a large banner with the text 'Download the latest version for Windows' in yellow. Below this text is a yellow button labeled 'Download Python 3.7.3'. Further down, there are links for 'Python for Windows', 'Linux/UNIX, Mac OS X, Other', and 'Pre-releases'. The banner background shows two yellow and white striped parachutes against a blue sky with clouds.

# Python



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- Anaconda (for Jupyter Notebook)

→ ↻ 🔒 <https://www.anaconda.com/distribution/>

Apps Google Earth

ANACONDA

Products Why Anaconda? Solution

## Anaconda Distribution

The World's Most Popular Python/R Data Science Platform

Download

- Way to integrate Geometric Algebra to **Mathematica**

# Octave



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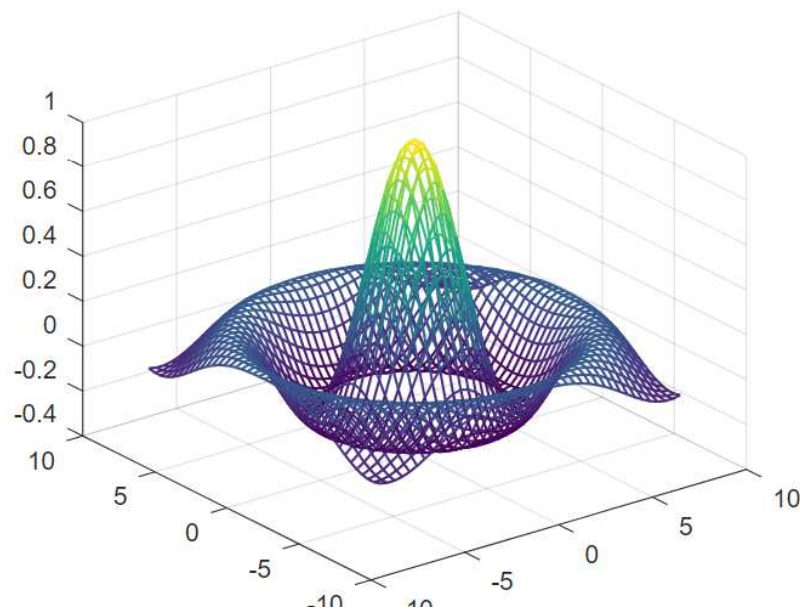
<https://www.gnu.org/software/octave/>



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## Scientific Programming Language

- Powerful mathematics-oriented syntax with built-in plotting and visualization tools
- Free software, runs on GNU/Linux, macOS, BSD, and Windows
- Drop-in compatible with many Matlab scripts

[Download](#)

[Docs](#)



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Thanks a lot ...

## ▪ Installationsanleitung auf Homepage

### Geometric Algebra Computing

#### Links

- [CLUCalc](#)

Eine sehr einfach zu bedienende Geometric Algebra Visualisierungs- und Scripting-Software, die trotz der Einfachheit auch Entwicklung komplexerer Algorithmen ermöglicht.

CLUCalc 6.x gibt es aktuell leider nur für Windows. Von der alten Version 4.x gibt es zwar auch eine Linux-Build, jedoch besteht weder eine vollständige Abwärts- noch eine vollständige Aufwärtskompatibilität zwischen 4.x und 6.x. Also sind einige Probleme für den Fall zu erwarten, dass man Scripte zwischen den Versionen austauscht.

Die Installation von CLUCalc selber ist sehr straightforward - sofern man auch funktionierenden LaTeX-Support möchte, wird es etwas komplizierter.

Im folgenden eine Installationsanleitung für (hoffentlich funktionierenden ;) ) LaTeX-Support, die zumindest auf zwei meiner Rechner keine Probleme ergab.

1. Sofern noch nicht getan: [miktex](#) installieren - ich habe noch Version 2.7, aktuell scheint die 2.8 zu