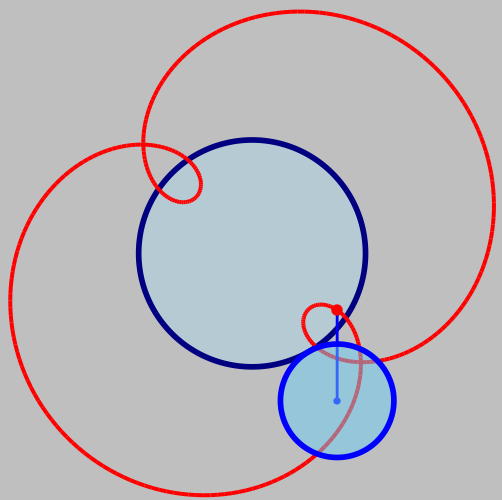
pst-sphericaltrochoid

Spherical Trochoids with PSTricks; v.0.01

December 25, 2025



Package author(s):
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This package involves the drawing of spherical trochoids with PSTricks using the command `\psSphericalTrochoid[`*options*`]`. A spherical trochoid motion is one of the following:

- rolling of a circle k on a circle $k0$ (both in the same sphere)
- rolling of two concentric (not coaxial) cones of revolution
- rolling of a sphere on two coaxial circles

1 The sources

There is, of course, the reference https://mathcurve.com/courbes3d/cycloidspheric/trochoidspheric.shtml, which includes the formulas and is beautifully illustrated. [2] Patrick Clément attempted this with GeoGebra: https://www.geogebra.org/m/RCyfhMqw, but the source file is missing. [1]

This package is based on the work of Erik Mahieu, who does it with Mathematica[1] https://demonstrations.wolfram.com/SphericalTrochoid/. [4] There are two advantages over the previous methods: the simplicity of the diagram, which only shows the essentials, and especially the proof of the equations.

The following animations were created with the package; the `.tex` files are included in the zip archive.

2 The options for \psSphericalTrochoid

`rB=1` : radius of the base disk;

`rR=1` : radius of the rolling disk;

`rG=1` : distance from the generating point to the center of the rolling disk;

`w=90` : angle in degrees formed between the xy plane and the plane of the rolling disk ($0 < \omega < \pi$);

`t=30` : angular displacement, in degrees, of the rotating disk around the edge of the base disk;

`tmax=360` : maximum angular displacement for drawing the curve;

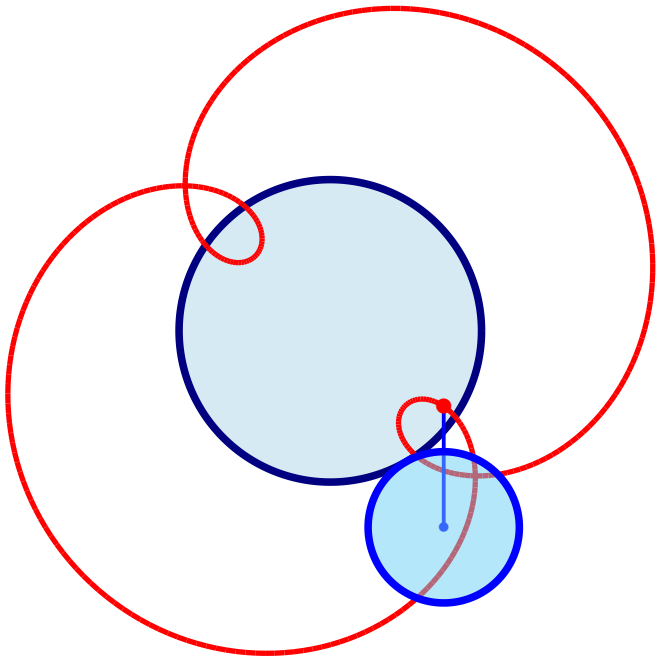
`Sphere=true` : a boolean value to determine whether or not to draw the sphere, set to true by default.

The `linecolor=red` option in PSTricks allows you to choose the color of the curve (red by default). The options `viewpoint=500 0 30 rtp2xyz`, `Decran=1000` and `resolution=360` of package `pst-solides3d` are the default options; they will be modified if necessary in the command, as shown in the next example:

1 Erik Mahieu is the author of numerous remarkable projects: https://demonstrations.wolfram.com/author.html?author=Erik+Mahieu

Using the macro

```
\begin{pspicture}(-5,-5)(5,5)
\psSphericalTrochoid[Sphere=false,rG=0.8,rR=0.5,viewpoint=500 0 90 rtp2xyz,w=180]
\end{pspicture}
```

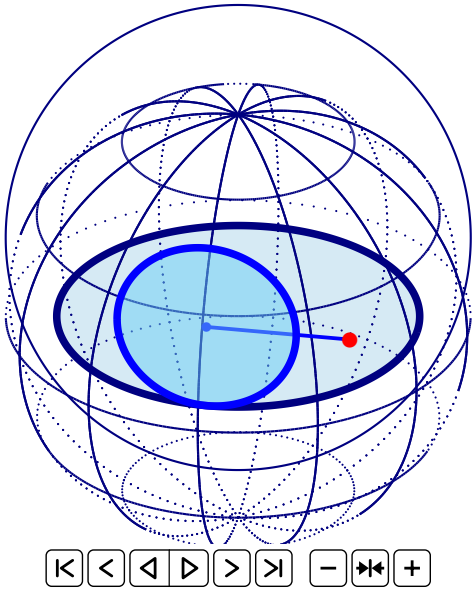


3 Examples

View the following animations with the AdopeReader.

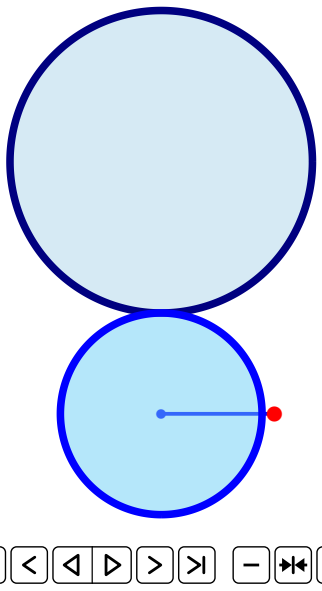
Creating an inline animation with package animate

```
\begin{animateinline}[controls,palindrome,
                      begin={\begin{pspicture}[showgrid=](-5,-3)(5,5)},
                      end={\end{pspicture}}]{10}% 10 images/s
\multiframe{37}{i=0+10}{%
  \psSphericalTrochoid[rG=0.8,rR=0.5,tmax=\i,t=\i,Decran=1200,viewpoint=500 10 30 rtp2xyz]}
\end{animateinline}
```



Creating an inline animation with package animate

```
\begin{animateinline}[controls,palindrome,
                      begin={\begin{pspicture}[showgrid=](-5,-5)(5,5)},
                      end={\end{pspicture}}]{10}% 10 images/s
  \multiframe{73}{i=0+10}{%
    \psSphericalTrochoid[Sphere=false,rG=0.75,rR=0.66667,tmax=\i,t=\i,viewpoint=500 0 90 rtp2xyz,
                         w=180]}
\end{animateinline}
```



4 Animation

The conversion to `.gif` is done by the program `magick`, formerly known as `convert`:

Converting pdf to gif

```
magick convert -delay 5 -density 100x100 -alpha remove anim1.pdf -loop 0 anim1.gif
```

The example files are saved in the directory `animations/`.

References

[1] Patrick Clément. *Spherical Trochoid*. GeoGebra. 2025. URL: https://www.geogebra.org/m/RCyfhMqw (visited on 12/21/2025) (cit. on p. 2).

[2] Robert Ferréol and Alain Eeculier. *Trochoïde Sphérique, Spherical trochoid, Kugeltrochoide*. 2009. URL: https://mathcurve.com/courbes3d/cycloidspheric/trochoidspheric.shtml (visited on 12/21/2025) (cit. on p. 2).

[3] Walther Jank, Georg Glaeser, and Boris Odehnal. "On the geometry of spherical trochoids". In: *23rd Scientific-Professional Colloquium on Geometry and Graphics*. Vinkovci, Croatia, Sept. 3–7, 2023. URL: http://sodwana.uni-ak.ac.at/geom/mitarbeiter/odehnal/talk/vinkovci_jgo.pdf (visited on 12/21/2025).

[4] Erik Mahieu. see also https://www.youtube.com/watch?v=V3KLZCjFHZY. WOLFRAM Demonstrations Project. 2016. URL: https://demonstrations.wolfram.com/SphericalTrochoid/ (visited on 12/21/2025) (cit. on p. 2).

[5] Helmut Pottmann. "Zur Geometrie höherer Planetenumschwungbewegungen". In: *Monatshefte für Mathematik* 97 (2 June 1, 1984), pp. 141–156. ISSN: 1436-5081. DOI: 10.1007/BF01653244. URL: https://doi.org/10.1007/BF01653244.

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