

Quelques figures acoustiques de Chladni pour une membrane circulaire

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On trouvera quelques éléments de théorie sur le site de Derek Kverno et Jim Nolen :

<http://webphysics.davidson.edu/alumni/jimn/chladni/pages/menu.htm>

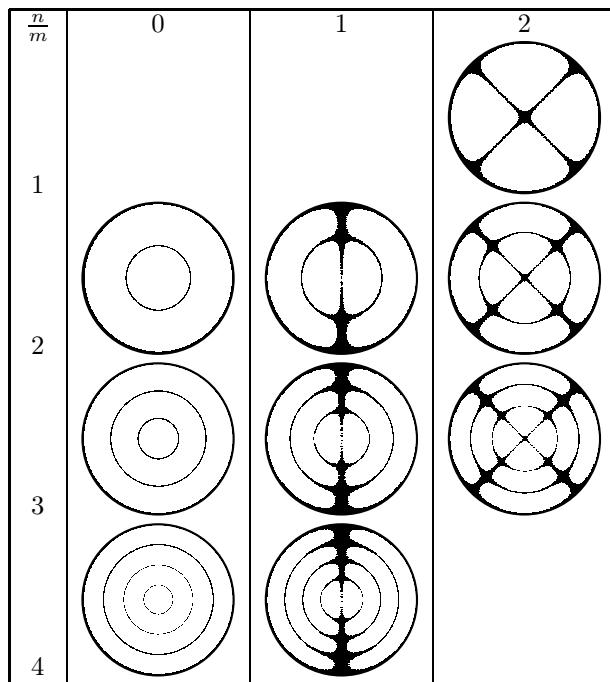
Ce sont deux commandes PStricks, qui comprennent très peu d'options :

- `\psnodallinescircularplate[n=1,m=1,R=1]`
- `pscircularmembrane[date=0,n=0,m=1,coeffZ=1]`

Elles permettent l'une de tracer les lignes nodales dans le plan en simulant la répartition des grains de sable et l'autre la déformation en 3D à un instant donné de la plaque.

[R=1] est le rayon de la membrane, [coeffZ=1] est un facteur d'échelle suivant z,[n=1,m=1] sont les modes de vibration et [date=0] permet de visualiser la plaque en 3D à un instant donné.

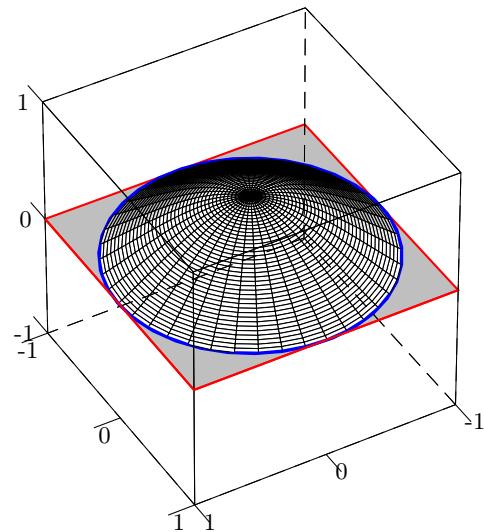
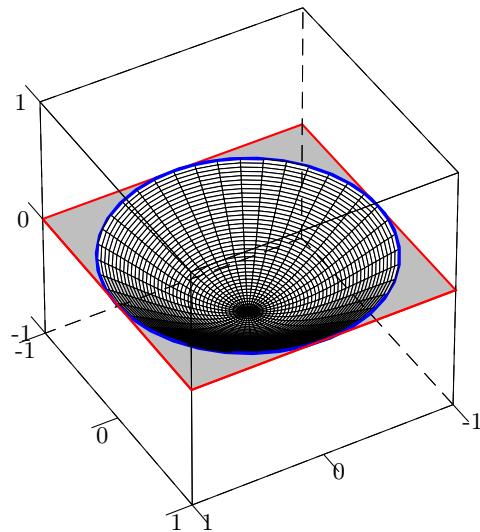
En plus de la commande PStricks, il y a aussi le code Maple permettant de dessiner la figure en 3D, ce qui vous permettra, éventuellement, de comparer les figures.



```

\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[date=0.8709]
\end{pspicture}
\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[date=0.435457]
\end{pspicture}

```



```

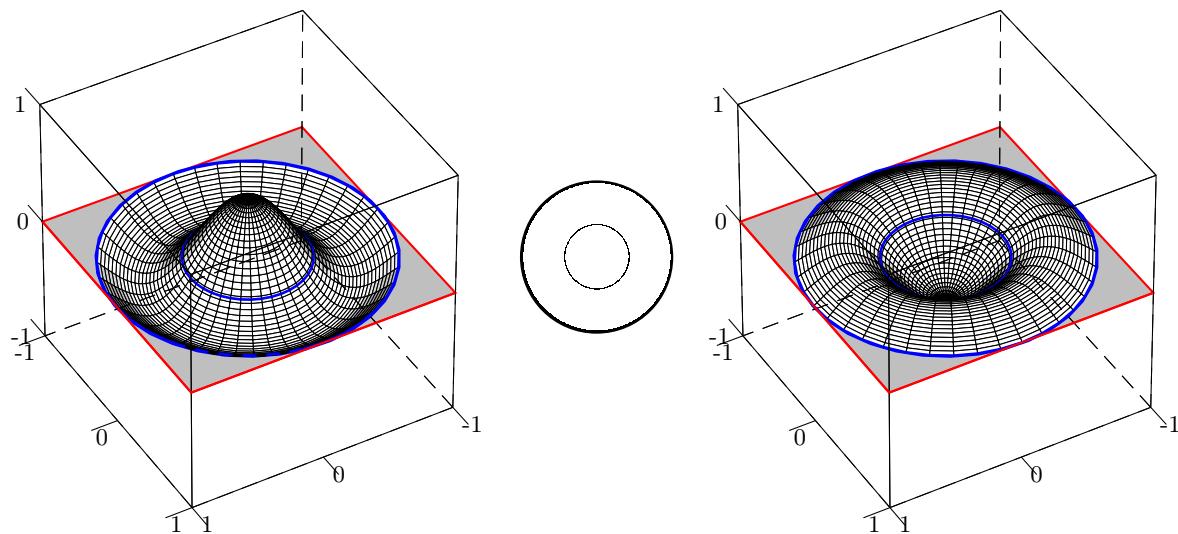
> alpha1:=BesselJZeros(0,1);
> v:=(r,t)->BesselJ(0,alpha1*r)*cos(alpha1*t);
> plot3d([r,theta,v(r,0)],r=0..1,theta=-Pi..Pi,coords=cylindrical,axes=frame);

```

```

\begin{pspicture}(-4,-4)(4,5)%
\pscircularmembrane[n=0,m=2,coeffZ=0.5]
\end{pspicture}
\begin{pspicture}(-0.5,-4)(0.5,5)
\psnodallinescircularplate[n=0,m=2]
\end{pspicture}
\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=0,m=2,date=0.435457,coeffZ=0.5]
\end{pspicture}

```



```

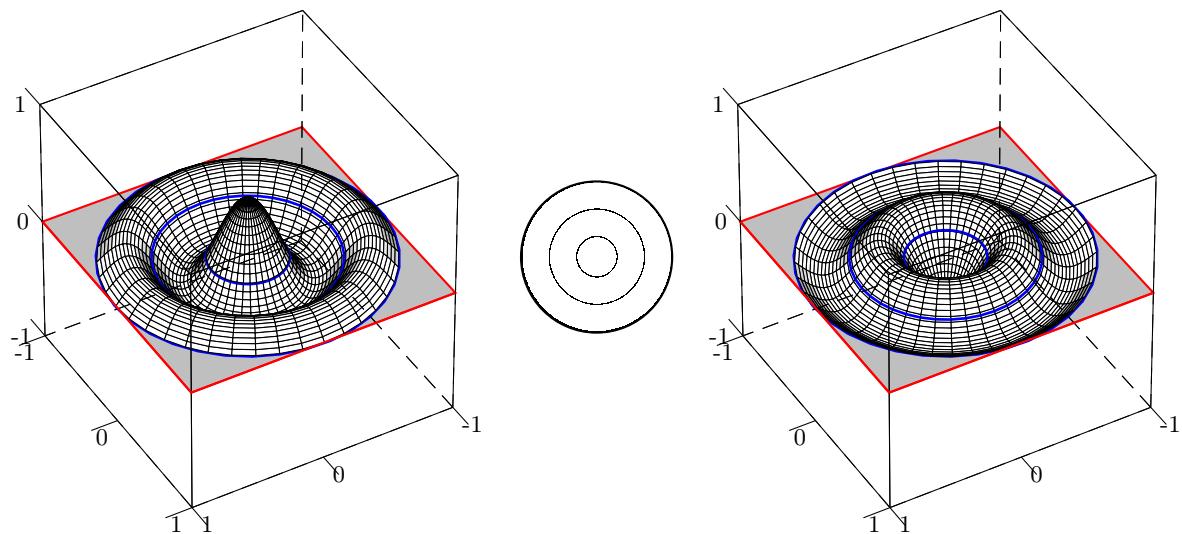
> alpha2:=BesselJZeros(0,2);
> v:=(r,t)->BesselJ(0,alpha2*r)*cos(alpha2*t);
> plot3d([r,theta,v(r,0)],r=0..1,theta=-Pi..Pi,coords=cylindrical,axes=frame);

```

```

\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=0,m=3,coeffZ=0.5]
\end{pspicture}
\begin{pspicture}(-0.5,-4)(0.5,5)
\psnodallinescircularplate[n=0,m=3]
\end{pspicture}
\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=0,m=3,date=0.435457,coeffZ=0.5]
\end{pspicture}

```



```

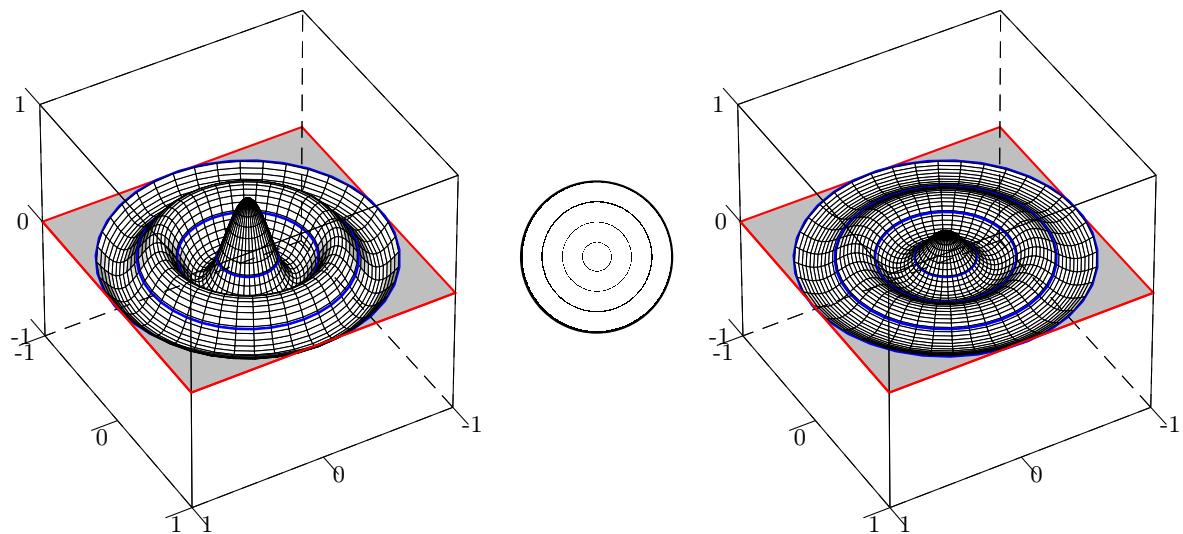
> alpha3:=BesselJZeros(0,3);
> v:=(r,t)->BesselJ(0,alpha3*r)*cos(alpha3*t);
> plot3d([r,theta,v(r,0)],r=0..1,theta=-Pi..Pi,coords=cylindrical,axes=frame);

```

```

\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=0,m=4,coeffZ=0.5]
\end{pspicture}
\begin{pspicture}(-0.5,-4)(0.5,5)
\psnodallinescircularplate[n=0,m=4]
\end{pspicture}
\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=0,m=4,date=0.435457,coeffZ=0.5]
\end{pspicture}

```



```

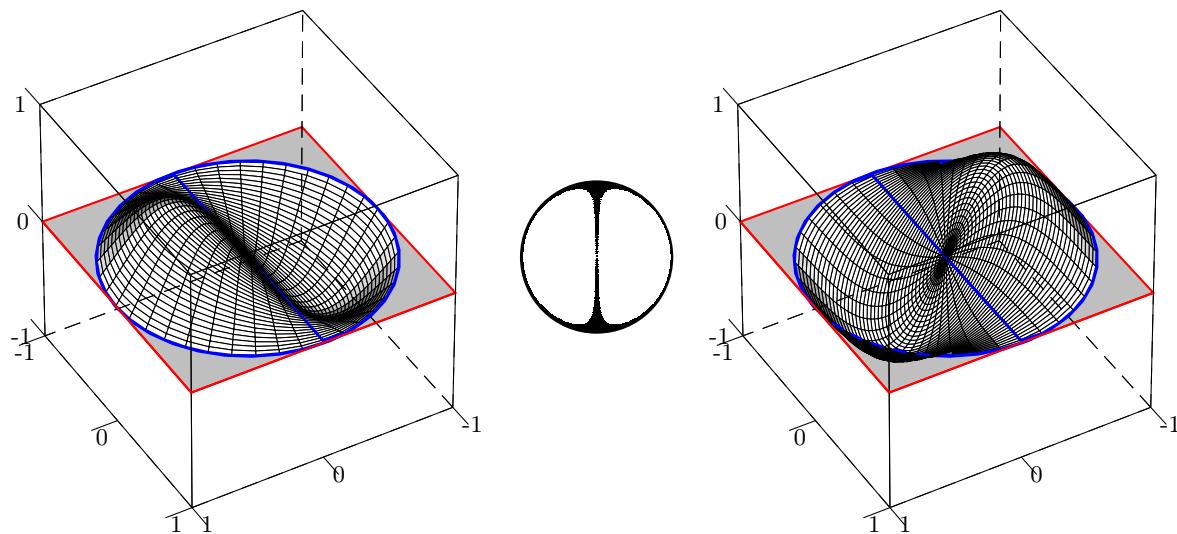
> alpha4:=BesselJZeros(0,4);
> v:=(r,t)->BesselJ(0,alpha4*r)*cos(alpha4*t);
> plot3d([r,theta,v(r,0)],r=0..1,theta=-Pi..Pi,coords=cylindrical,axes=frame);

```

```

\begin{pspicture}(-4,-4)(4,5)%
\pscircularmembrane[n=1,m=1]
\end{pspicture}
\begin{pspicture}(-0.5,-4)(0.5,5)
\psnodallinescircularplate[n=1,m=1]
\end{pspicture}
\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=1,m=1,date=0.82]
\end{pspicture}

```



```

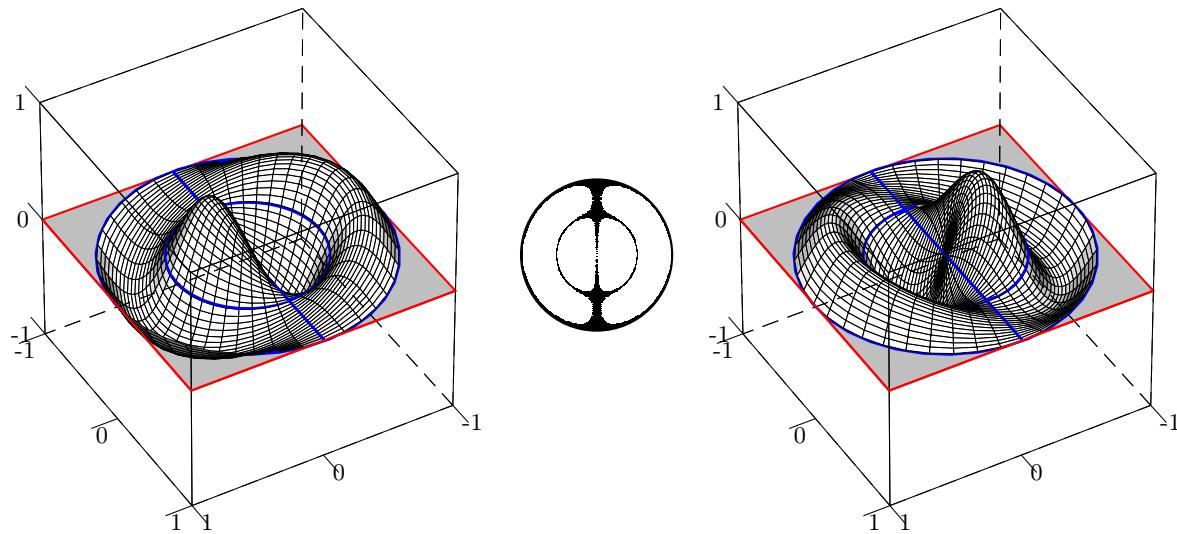
> alpha[1,1]:=BesselJZeros(1,1);
> u:=(r,theta,t)->BesselJ(1,alpha[1,1]*r)*cos(theta)*cos(alpha[1,1]*t);
> plot3d([r,theta,u(r,theta,0)],r=0..1,theta=-Pi..Pi,coords=cylindrical,
axes=frame);

```

```

\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=1,m=2]
\end{pspicture}
\begin{pspicture}(-0.5,-4)(0.5,5)
\psnodallinescircularplate[n=1,m=2]
\end{pspicture}
\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=1,m=2,date=0.448]
\end{pspicture}

```



```

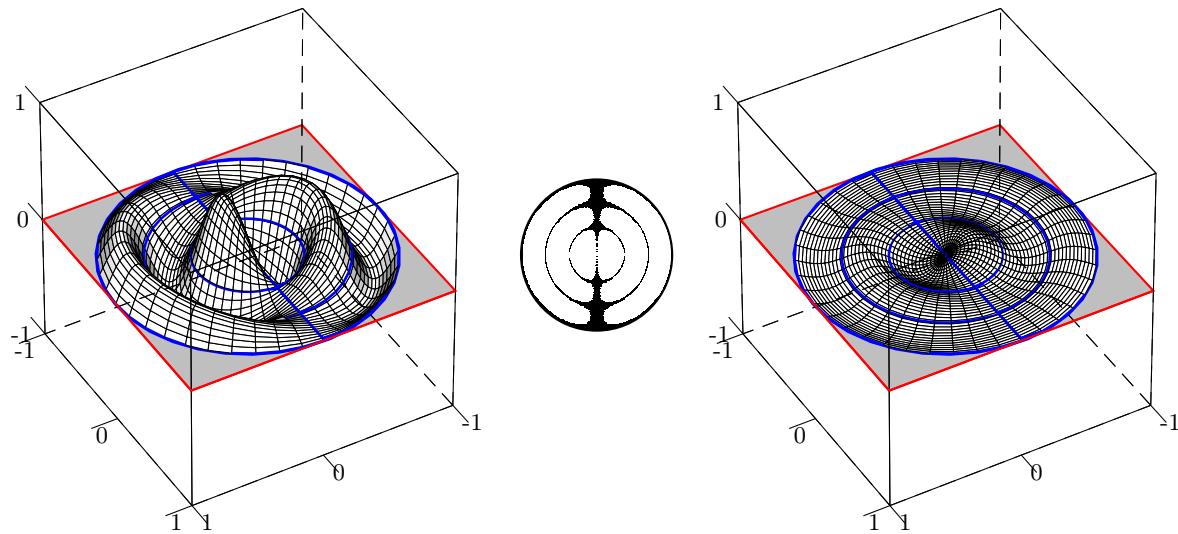
> alpha[1,2]:=BesselJZeros(1,2);
> u:=(r,theta,t)->BesselJ(1,alpha[1,2]*r)*cos(theta)*cos(alpha[1,2]*t);
> plot3d([r,theta,u(r,theta,0)],r=0..1,theta=-Pi..Pi,coords=cylindrical,
axes=frame);

```

```

\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=1,m=3]
\end{pspicture}
\begin{pspicture}(-0.5,-4)(0.5,5)
\psnodallinescircularplate[n=1,m=3]
\end{pspicture}
\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=1,m=3,date=0.448]
\end{pspicture}

```



```

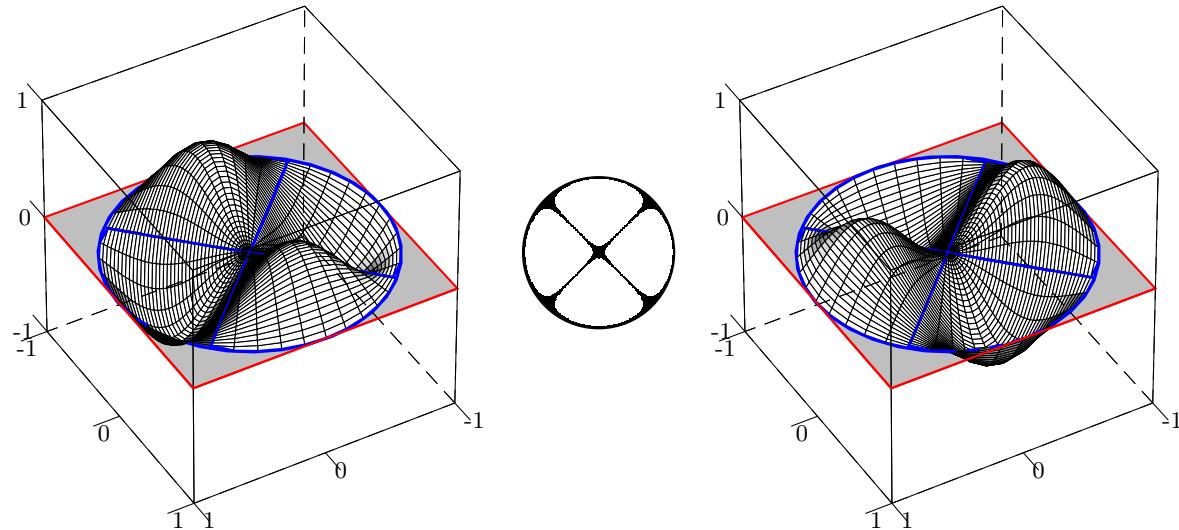
> alpha[1,3]:=BesselJZeros(1,3);
> u:=(r,theta,t)->BesselJ(1,alpha[1,3]*r)*cos(theta)*cos(alpha[1,3]*t);
> plot3d([r,theta,u(r,theta,0)],r=0..1,theta=-Pi..Pi,coords=cylindrical,
axes=frame);

```

```

\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=2,m=1,,date=0.617]
\end{pspicture}
\begin{pspicture}(-0.5,-4)(0.5,5)
%\rput(0,0){\includegraphics{lignes-nodales-2-1.eps}}
\psnodallinescircularplate[n=2,m=1]
\end{pspicture}
\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=2,m=1]
\end{pspicture}

```



```

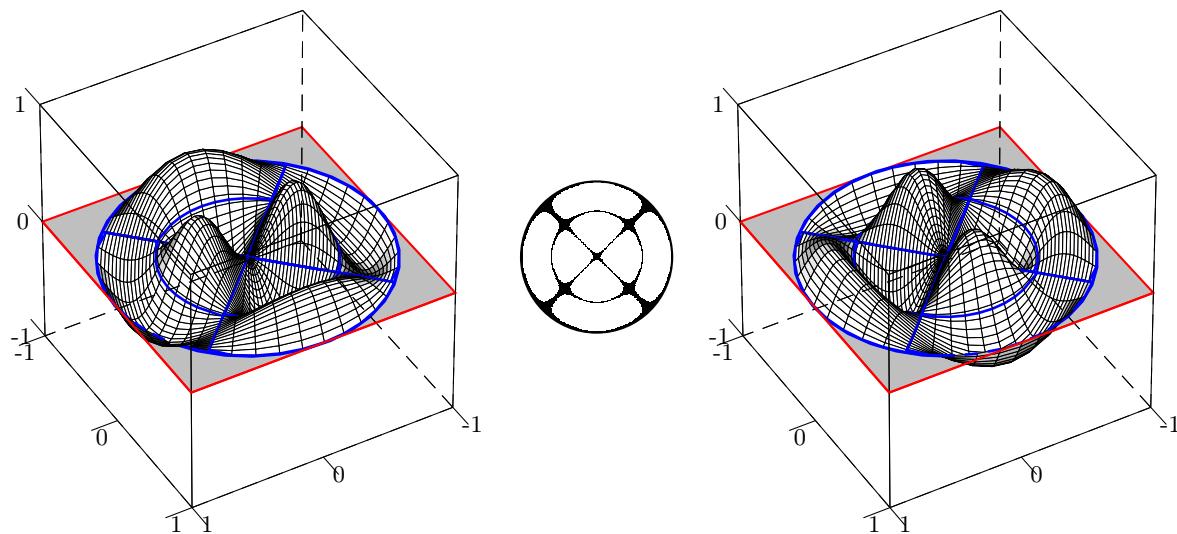
> alpha[2,1]:=BesselJZeros(2,1);
> u:=(r,theta,t)->BesselJ(2,alpha[2,1]*r)*cos(2*theta)*cos(alpha[2,2]*t);
> plot3d([r,theta,u(r,theta,0)],r=0..1,theta=-Pi..Pi,coords=cylindrical,
axes=frame);

```

```

\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=2,m=2]
\end{pspicture}
\begin{pspicture}(-0.5,-4)(0.5,5)
\psnodallinescircularplate[n=2,m=2]
\end{pspicture}
\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=2,m=2,date=0.372]
\end{pspicture}

```



```

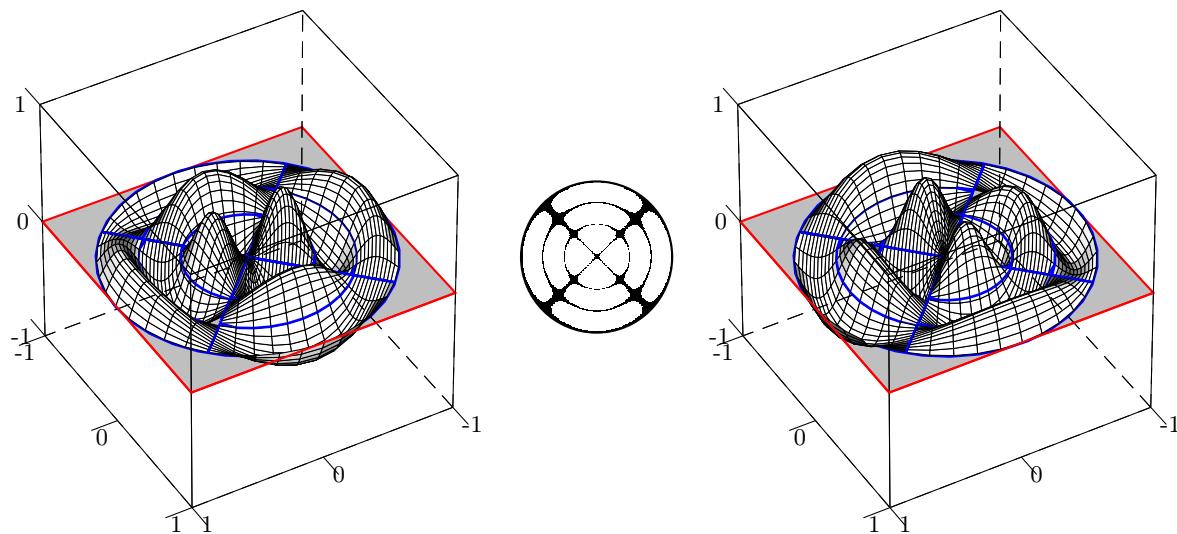
> alpha[2,2]:=BesselJZeros(2,2);
> u:=(r,theta,t)->BesselJ(2,alpha[2,2]*r)*cos(2*theta)*cos(alpha[2,2]*t);
> plot3d([r,theta,u(r,theta,0)],r=0..1,theta=-Pi..Pi,coords=cylindrical,
axes=frame);

```

```

\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=2,m=3]
\end{pspicture}
\begin{pspicture}(-0.5,-4)(0.5,5)
\psnodallinescircularplate[n=2,m=3]
\end{pspicture}
\begin{pspicture}(-4,-4)(4,5)
\pscircularmembrane[n=2,m=3,date=0.270365]
\end{pspicture}

```



```

> alpha[2,3]:=BesselJZeros(2,3);
> u:=(r,theta,t)->BesselJ(2,alpha[2,3]*r)*cos(2*theta)*cos(alpha[2,3]*t);
> plot3d([r,theta,u(r,theta,0)],r=0..1,theta=-Pi..Pi,coords=cylindrical,
axes=frame);

```