

■ B-Spline

Buch: Höhere Mathematik sehen und verstehen, Haftendorn, Riebesehl, Dammer,
Springer Spektrum, Feb. 2021

Datei [NURBS-Torus.nb](#) zu Abschnitt 5.4.3.4 Seite 381, Abb. 5.24



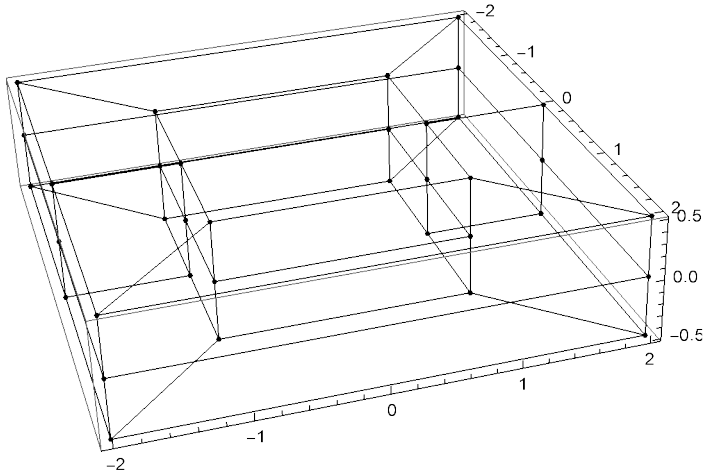
● Torus

```
pts = {{ {0, -2, 0}, {0, -2, 0.5}, {0, -1, 0.5},
        {0, -1, 0}, {0, -1, -0.5}, {0, -2, -0.5}, {0, -2, 0}},
       {{2, -2, 0}, {2, -2, 0.5}, {1, -1, 0.5}, {1, -1, 0},
        {1, -1, -0.5}, {2, -2, -0.5}, {2, -2, 0}},
       {{2, 2, 0}, {2, 2, 0.5}, {1, 1, 0.5}, {1, 1, 0}, {1, 1, -0.5}, {2, 2, -0.5}, {2, 2, 0}},
       {{0, 2, 0}, {0, 2, 0.5}, {0, 1, 0.5}, {0, 1, 0}, {0, 1, -0.5}, {0, 2, -0.5}, {0, 2, 0}},
       {{-2, 2, 0}, {-2, 2, 0.5}, {-1, 1, 0.5},
        {-1, 1, 0}, {-1, 1, -0.5}, {-2, 2, -0.5}, {-2, 2, 0}},
       {{-2, -2, 0}, {-2, -2, 0.5}, {-1, -1, 0.5}, {-1, -1, 0}, {-1, -1, -0.5},
        {-2, -2, -0.5}, {-2, -2, 0}}, {{0, -2, 0}, {0, -2, 0.5},
        {0, -1, 0.5}, {0, -1, 0}, {0, -1, -0.5}, {0, -2, -0.5}, {0, -2, 0}}};

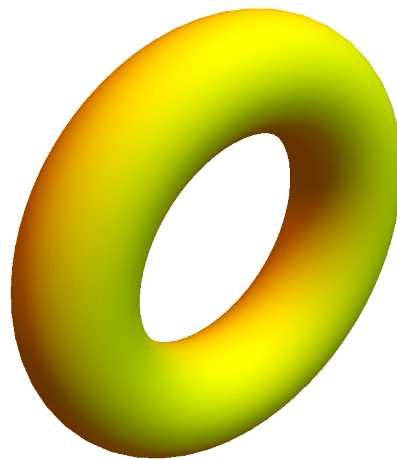
w = { {1, .5, .5, 1, .5, .5, 1}, {1, .5, .5, 1, .5, .5, 1} / 2,
      {1, .5, .5, 1, .5, .5, 1} / 2, {1, .5, .5, 1, .5, .5, 1}, {1, .5, .5, 1, .5, .5, 1} / 2,
      {1, .5, .5, 1, .5, .5, 1} / 2, {1, .5, .5, 1, .5, .5, 1}};

uk = {0, 0, 0, 1/4, 1/2, 1/2, 3/4, 1, 1, 1};
vk = {0, 0, 0, 1/4, 1/2, 1/2, 3/4, 1, 1, 1};
```

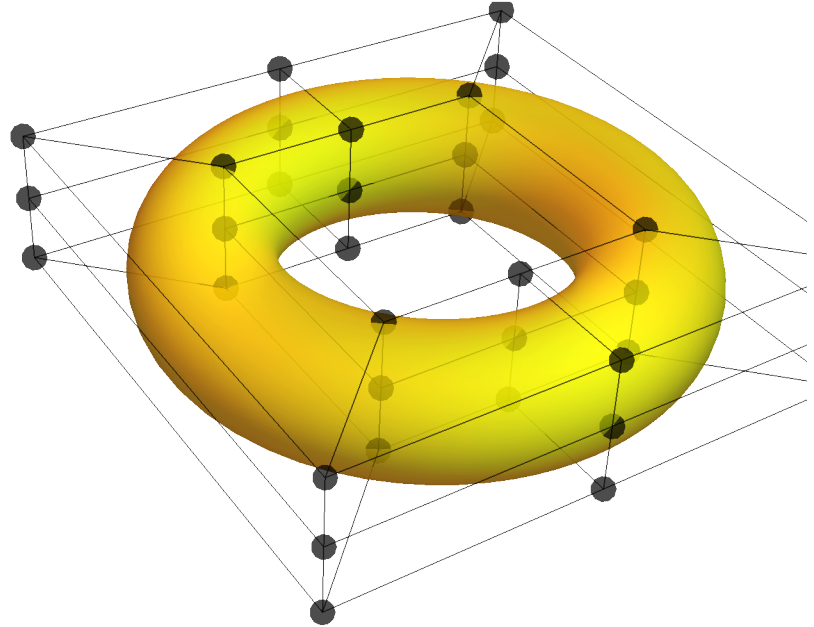
```
Graphics3D[{Point[Flatten[pts, 1]], Line[pts], Line[pts // Transpose]}, Axes → True]
```



```
Graphics3D[{  
  FaceForm[Yellow],  
  BSplineSurface[pts, SplineKnots → {uk, vk}, SplineDegree → 2, SplineWeights → w,  
  SplineClosed → {True, True}], ViewPoint → {Right, Front}, Boxed → False]
```



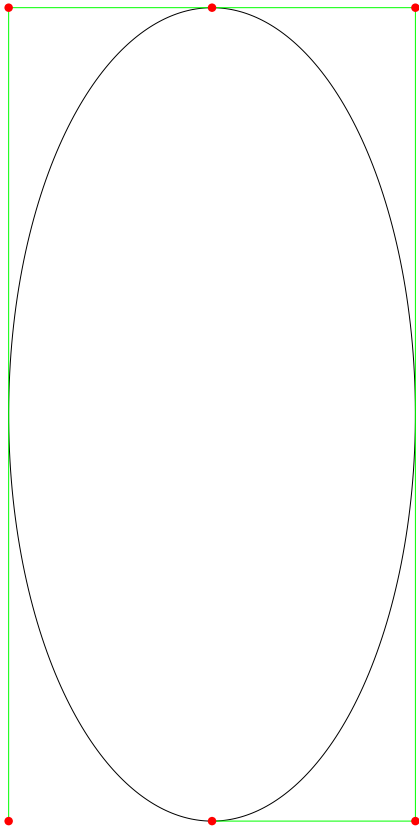
```
Graphics3D[{
  FaceForm[Yellow], Opacity[0.7], PointSize[0.03],
  BSplineSurface[pts, SplineKnots -> {uk, vk}, SplineDegree -> 2,
    SplineWeights -> w, SplineClosed -> {True, True}], Point[Flatten[pts, 1]],
  Line[pts], Line[pts // Transpose]], ViewPoint -> {Right, Front}, Boxed -> False]
```



● Ellipse: Vorbereitung mit Kurven

```
pts = {{.5, 0}, {1, 0}, {1, 2}, {.5, 2}, {0, 2}, {0, 0}};
w = {1, .5, .5, 1, .5, .5};
k = {0, 0, 0, 1/4, 1/2, 1/2, 3/4, 1, 1, 1};
```

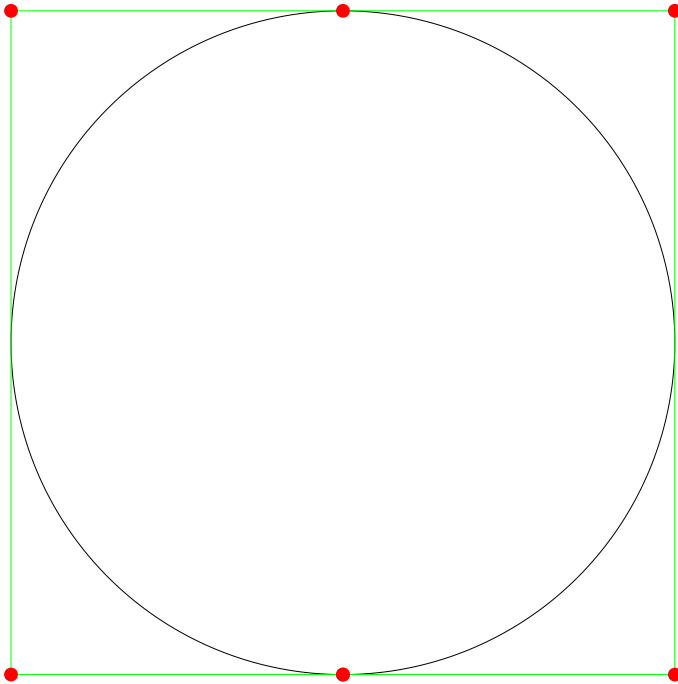
```
Graphics[{BSplineCurve[pts, SplineDegree → 2, SplineKnots → k, SplineWeights → w,  
SplineClosed → True], Green, Line[pts], Red, PointSize[0.02], Point[pts]}]
```



● Kreis: spezielle Ellipse

```
pts = {{.5, 0}, {1, 0}, {1, 1}, {.5, 1}, {0, 1}, {0, 0}, {.5, 0}};  
w = {1, .5, .5, 1, .5, .5, 1};  
k = {0, 0, 0, 1/4, 1/2, 1/2, 3/4, 1, 1, 1};
```

```
Graphics[{BSplineCurve[pts, SplineDegree → 2, SplineKnots → k, SplineWeights → w],
  Green, Line[pts], Red, PointSize[0.02], Point[pts]}]
```



● Rohr: Vorbereitung und Anregung für den Torus

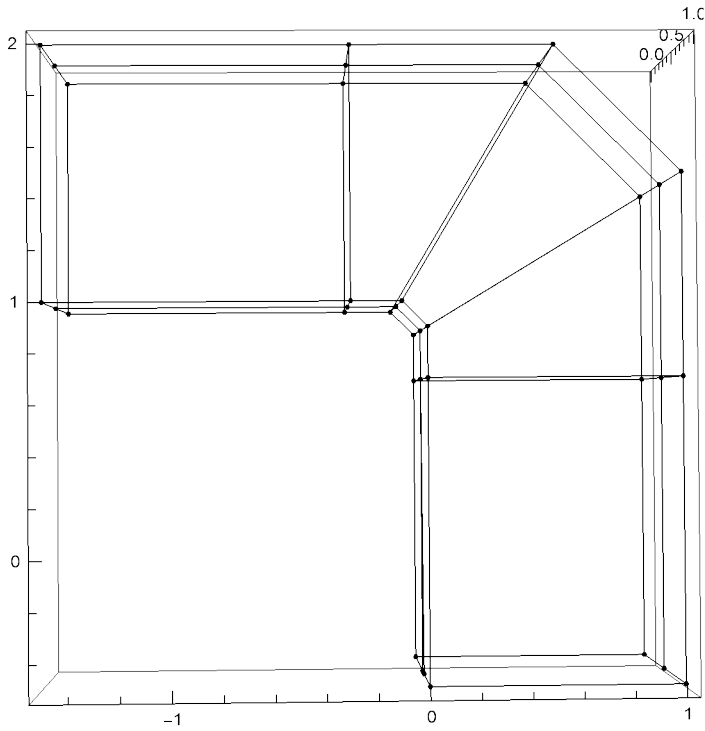
```
pts = {{{{0.6, 0, -0.5}, {0, 0, -0.5}, {0, 1, -0.5},
  {0.5, 1, -0.5}, {1, 1, -0.5}, {1, 0, -0.5}, {0.5, 0, -0.5}},
  {{0.5, 0, 0.7}, {0, 0, 0.7}, {0, 1, 0.7}, {0.5, 1, 0.7},
  {1, 1, 0.7}, {1, 0, 0.7}, {0.5, 0, 0.7}},
  {{0.5, 0, 0.9}, {0, 0, 0.9}, {0, 1, 1.5}, {0.5, 1, 1.5},
  {1, 1, 1.5}, {1, 0, 0.9}, {0.5, 0, 0.9}},
  {{0.5, -0.1, 1}, {0, -0.1, 1}, {0, 0.5, 2}, {0.5, 0.5, 2},
  {1, 0.5, 2}, {1, -0.1, 1}, {0.5, -0.1, 1}},
  {{0.5, -0.3, 1}, {0, -0.3, 1}, {0, -0.3, 2}, {0.5, -0.3, 2},
  {1, -0.3, 2}, {1, -0.3, 1}, {0.5, -0.3, 1}},
  {{0.5, -1.5, 1}, {0, -1.5, 1}, {0, -1.5, 2}, {0.5, -1.5, 2},
  {1, -1.5, 2}, {1, -1.5, 1}, {0.5, -1.5, 1}}};

w = {{1, .5, .5, 1, .5, .5, 1}, {1, .5, .5, 1, .5, .5, 1}, {1, .5, .5, 1, .5, .5, 1},
  {1, .5, .5, 1, .5, .5, 1}, {1, .5, .5, 1, .5, .5, 1}, {1, .5, .5, 1, .5, .5, 1}};

uk = {0, 0, 0, 1/4, 1/2, 3/4, 1, 1, 1};

vk = {0, 0, 0, 1/4, 1/2, 1/2, 3/4, 1, 1, 1};
```

```
Graphics3D[{Point[Flatten[pts, 1]], Line[pts], Line[pts // Transpose]}, Axes -> True]
```



```
Graphics3D[{
  FaceForm[Yellow, Blue],
  BSplineSurface[pts, SplineKnots -> {uk, vk}, SplineDegree -> 2, SplineWeights -> w,
  SplineClosed -> {False, True}], ViewPoint -> {Right, Front}, Boxed -> False]
```

