

Needs ["SpinDynamica`"]

```
SpinDynamica version 3.0.1 loaded
```

ModifyBuiltIn: The following built-in routines have been modified in SpinDynamica:

{Chop, Dot, Duration, Exp, Expand, ExpandAll, NumericQ, Plus, Power, Simplify, Times, WignerD}.

Evaluate `??symbol` to generate the additional definitions for *symbol*.

```
SetOptions[Graphics3D, ViewPoint -> {5, 2, 1},  
SphericalRegion -> True, PlotRange -> Table[{-1.1, 1.1}, {3}]];
```

Arrow3D, Axes3D, AxisSystem

? Arrow3D

Arrow3D[begin, end, opts] generates graphics primitives for an arrow in 3D space. Arrow3D[end, opts] draws from the origin. Arrow3D now uses the inbuilt functionality of Arrow in Mathematica 7 to specify the arrow head. The option Tube -> True can be used to specify that the arrow and heads are drawn as tubes. If a numeric value is used for the Tube option, that value is used as the tube radius.

? Axes3D

Axes3D[{x,y,z}, pt, opts] draws a set of arrowed axes centred at pt, along the vectors specified by {x,y,z}. If pt is absent, the origin is assumed. An incomplete axes specification may be given, i.e. Axes3D[{x,z}, pt, opts] or Axes3D[{z}, pt, opts], as in AxisSystem. The axis orientations may also be specified using Euler angles, as in Axes3D[{ α, β, γ }, pt, opts] (orientation relative to the default coordinate system), or Axes3D[{ α, β, γ }, {x,y,z}, pt, opts] (orientation relative to the coordinate system {x,y,z}).

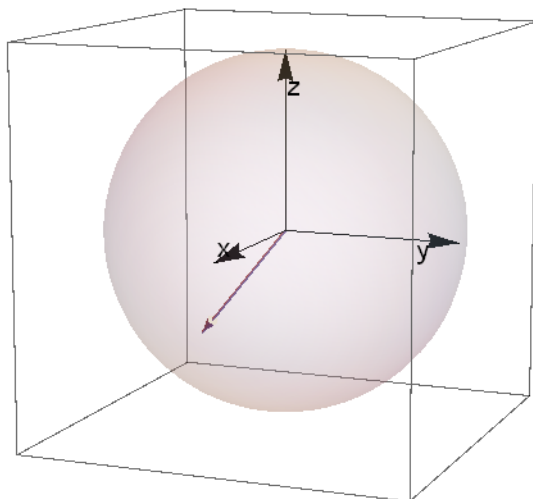
? AxisSystem

AxisSystem[vz] generates a normalized right-handed axis system with three orthogonal axes, the last one parallel to vz. The first axis is in (ex,vz) plane. AxisSystem[vx,vz] generates a normalized right-handed axis system with first axis in {vx,vz} plane and third axis parallel to vz. AxisSystem[vx,vy,vz] generates a normalized right-handed axis system if the input vectors are already orthogonal. AxisSystem[] defaults to {ex,ey,ez}. AxisSystem[{vx,vy,vz}] has the same meaning as AxisSystem[vx,vy,vz]

construction of a 3D axis system with only the z-axis specified

```
vecz = Normalize@RandomReal[{-1, 1}, 3];
```

```
Show[{
  Axes3D[AxisSystem[ex, ez], Tube -> False],
  Arrow3D[vecz],
  Graphics3D[{Opacity[0.2], Sphere[Origin, 1]}]
}]
```



vecz

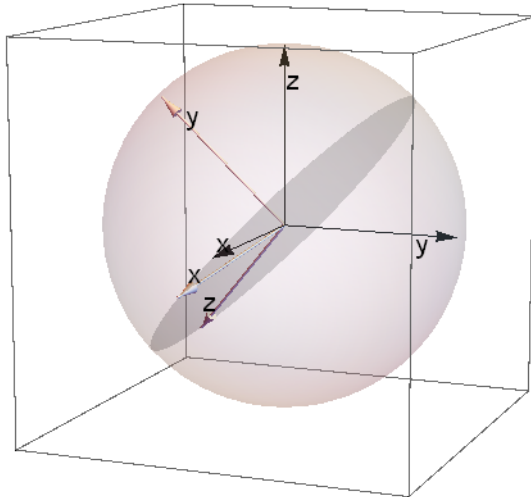
```
{-0.309968, -0.643101, -0.700244}
```

If the x-axis is not specified, AxisSystem places the x-axis of the new axis system in the plane of the specified vector and the old z-axis. This plane is shown in the plot below

```
{vecx, vecy, vecz} = AxisSystem[vecz]
```

```
{{0.950747, -0.209667, -0.228297},
 {0., -0.736519, 0.676416}, {-0.309968, -0.643101, -0.700244}}
```

```
Show[
  Axes3D[AxisSystem[ex, ez], Tube -> False],
  Axes3D[{vecx, vecy, vecz}],
  Graphics3D[{Opacity[0.2], Sphere[Origin, 1]}],
  Graphics3D[{Opacity[0.2], EdgeForm[], FaceForm[Black],
    Polygon[Table[vecx Cos[phi] + vecz Sin[phi], {phi, 0, 2 pi, 2 pi/100}]]}]
]
```



construction of a 3D axis system with two axes specified

If the x-axis is specified, AxisSystem places the new y-axis perpendicular to the specified x and y-axes

```
vecx = Normalize@RandomReal[{-1, 1}, 3]
```

```
{0.13842, 0.923551, -0.357623}
```

```
{-0.0871726, 0.518059, 0.850891}
```

```
{0.739173, -0.636908, -0.219025}
```

```
{-0.518754, 0.647691, 0.558024}
```

```
{-0.926584, 0.369101, 0.0721562}
```

```
{-0.30605, -0.50272, 0.808459}
```

```

{vecx, vecy, vecz} = AxisSystem[vecx, vecz]
{{0.0202124, 0.731895, -0.681117},
 {0.950532, -0.225278, -0.213866}, {-0.309968, -0.643101, -0.700244}}

{{-0.44967, 0.337862, 0.826829},
 {0.354723, -0.782017, 0.512466}, {0.819737, 0.523736, 0.231802}}

{{0.32883, -0.706825, 0.626314},
 {-0.666215, -0.643667, -0.376629}, {0.669349, -0.293413, -0.682555}}

{{-0.799442, 0.443142, 0.405607},
 {-0.0414167, 0.632913, -0.773115}, {-0.599313, -0.634859, -0.487624}}

{{-0.749058, 0.617546, -0.239894},
 {0.312404, 0.648564, 0.694096}, {0.584222, 0.444974, -0.678736}}

{{0.513755, 0.463291, 0.722092},
 {-0.751792, 0.648623, 0.118732}, {-0.413358, -0.603862, 0.681532}}

Show[{
  Axes3D[AxisSystem[ex, ez], Tube -> False],
  Axes3D[{vecx, vecy, vecz}],
  Graphics3D[{Opacity[0.2], Sphere[Origin, 1]}]
}]

```

