The Helix*

The helix is the simplest nonplanar space curve. It can be translated along itsself by a group of isometries (called *screw motions*) and therefore has its geometric invariants – the curvature and the torsion – constant.
Our (circular) helix as a parametrized curve c is given (with defaults $aa = bb = 1.5,\ cc = 0.25$) as

$$c(t) = (aa\cos(t),\ bb\sin(t),\ cc(t - tmin) - 3).$$

In the default `Morph` we extend the helix like pulling a bed spring and therefore want to keep its length constant. To do this we compute $f := (aa^2 + cc^2)^{-1/2}$ and show the reparametrized curve $c(f \cdot t)$.

Before we do the morph we select from the Action Menu `Show As Tube`. These tubes are either made with the 'Frenet Frame' or with a 'Parallel Frame'. The tube behaves like an elastic rod if we choose in the Action Menu `Parallel Frame`. The default morph now shows (at the right end, the left is kept fixed) that the tube also twists around itsself while it is extended. When this occurs with electrical wires or water hoses that are pulled sideways from their coil, it is a well known and annoying phenomenon.

H.K.

---

* This file is from the 3D-XplorMath project. Please see:

http://3D-XplorMath.org/