CZ2003 Tutorial 10 (2022/2023, Semester 1)

Motions

1. Propose an animation model in implicit representation, which defines the movement of a unit sphere along a 3D helical curve in a uniform speed along the z-direction (see Figure Q1). The helical curve has radius 30, period 10, and 15 full rotations. The animation sequence should have 160 frames.

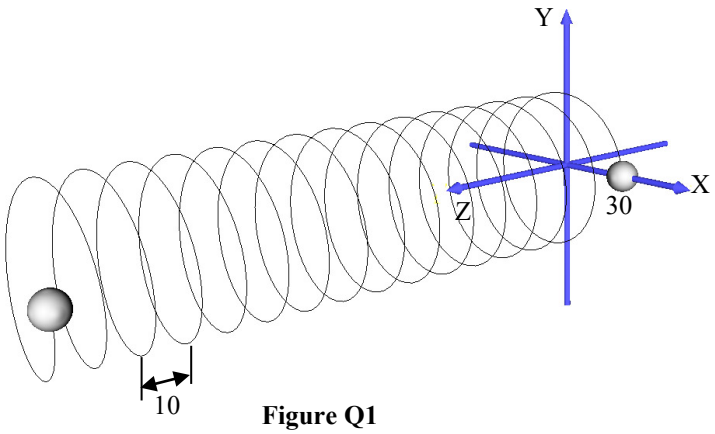

Figure Q1

2. A line segment bounded by two points (0,0,0) and (2,2,0) is rotated about the y-axis by 270 degrees. Using $x(u,t)$, $y(u,t)$, $z(u,t)$, $u,t \in [0,1]$, define parametrically an animation of the rotating line such that it shows some deceleration.

3. Figure Q3 displays a sequence of images (along the dash lines with arrows) showing the shape changes from shape A to shape B, where A is an ellipse with semi-axes of 2 and 1, and B is an ellipse with semi-axes of 1 and 2. By observing the pattern of changes of the images, propose an appropriate mathematical model using parametric functions to represent this animation.

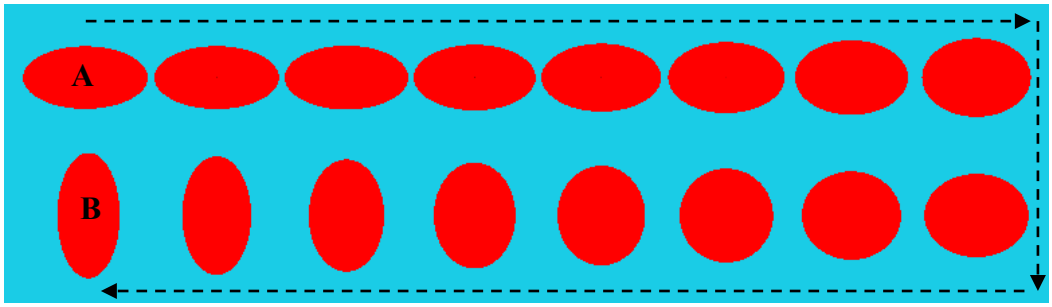

Figure Q3

4. Propose a mathematical model that implements morphing of transforming a solid unit sphere with center at the point (-1, 0, 0) into a solid cylinder parallel to axis *y* with radius 2, center at the point (-2, -2, 2) and height of 4. The morphing sequence should have 160 frames and involve deceleration.