

**SCHOOL OF COMPUTER SCIENCE AND ENGINEERING**

CZ2003 Computer Graphics & Visualization Lab 2 Submission

Parametric Curves

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# Lab 2 Tasks

1. Define parametrically in different files
   * straight line segment,
   * circle and its arc,
   * ellipse and its arc,
   * 2D spiral,
   * 3D helix.
2. Convert the explicitly defined curve y=sin(x) to parametric representation x(u), y(u) and define it in FVRML file.
3. Explore what happens when you change the curves resolutions to as little as 2 and see how the shape of the curves changes.
4. Change the curves parameter domain to see how they elongate or shorten.

# Lab 2 Files

1. Task 1 > Straight Line Segment > straight line segment.wrl
2. Task 1 > Circle > circle.wrl
3. Task 1 > Semi Circle > circle (semi).wrl
4. Task 1 > Minor Arc of Circle > circle (minor arc).wrl
5. Task 1 > Major Arc of Circle > circle (major arc).wrl
6. Task 1 > Ellipse > ellipse.wrl
7. Task 1 > Half Ellipse > ellipse (semi).wrl
8. Task 1 > Minor Arc of Ellipse > ellipse (minor arc).wrl
9. Task 1 > Major Arc of Ellipse > ellipse (major).wrl
10. Task 1 > 2D Spiral > 2D spiral.wrl
11. Task 1 > 3D Helix > 3D helix.wrl
12. Task 2 > Sin Curve > sin curve.wrl
13. Task 3 > Circle with 2 resolution > circle (2 resolution).wrl
14. Task 3 > Circle with 3 resolution > circle (3 resolution).wrl
15. Task 3 > Circle with 10 resolution > circle (10 resolution).wrl
16. Task 3 > Circle with 50 resolution > circle (50 resolution).wrl
17. Task 3 > 2D Spiral with 4 resolution > 2D spiral (4 resolution).wrl
18. Task 3 > Sin Curve with 10 resolution > sin curve (10 resolution).wrl
19. Task 4 > Straight Line Lengthen > straight line segment (lengthen).wrl
20. Task 4 > Straight Line Shorten > straight line segment (shorten).wrl
21. Task 4 > 2D Spiral Lengthen > 2D spiral (lengthen).wrl
22. Task 4 > 2D Spiral Shorten > 2D spiral (shorten).wrl
23. Task 4 > Sin Curve on positive x-axis only > sin curve (positive only).wrl
24. Task 4 > Sin Curve on negative x-axis only > sin curve (negative only).wrl

# Task 1: Define Parametrically In Different Files

## Straight Line Segment

|  |  |
| --- | --- |
| **Straight Line** | **Parametric Equation** |
|  | x = u;  y = u;  z = 0;  u ϵ [-1, 1] |

## Circle and Arcs

|  |  |
| --- | --- |
| **Circle** | **Parametric Equation** |
|  | x = cos(u\*pi);  y = sin(u\*pi);  z = 0;  u ϵ [0.0, 2.0] |

|  |  |
| --- | --- |
| **Semi Circle** | **Parametric Equation** |
|  | x = cos(u\*pi);  y = sin(u\*pi);  z = 0;  u ϵ [0.0, 1.0] |

|  |  |
| --- | --- |
| **Minor Arc of Circle** | **Parametric Equation** |
|  | x = cos(u\*pi);  y = sin(u\*pi);  z = 0;  u ϵ [0.5, 1.0] |

|  |  |
| --- | --- |
| **Major Arc of Circle** | **Parametric Equation** |
|  | x = cos(u\*pi);  y = sin(u\*pi);  z = 0;  u ϵ [0.5, 2.0] |

## Ellipse and Arcs

|  |  |
| --- | --- |
| **Ellipse** | **Parametric Equation** |
|  | x = 0.8\*cos(u\*pi);  y = 0.3\*sin(u\*pi);  z = 0;  u ϵ [0.0, 2.0] |

|  |  |
| --- | --- |
| **Half Ellipse** | **Parametric Equation** |
|  | x = 0.8\*cos(u\*pi);  y = 0.3\*sin(u\*pi);  z = 0;  u ϵ [0.0, 1.0] |

|  |  |
| --- | --- |
| **Minor Arc of Ellipse** | **Parametric Equation** |
|  | x = 0.8\*cos(u\*pi);  y = 0.3\*sin(u\*pi);  z = 0;  u ϵ [0.5, 1.0] |

|  |  |
| --- | --- |
| **Major Arc of Ellipse** | **Parametric Equation** |
|  | x = 0.8\*cos(u\*pi);  y = 0.3\*sin(u\*pi);  z = 0;  u ϵ [0.5, 2.0] |

## 2D Spiral

|  |  |
| --- | --- |
| **2D Spiral** | **Parametric Equation** |
|  | x = u\*cos(6\*u\*pi);  y = u\*sin(6\*u\*pi);  z = 0;  u ϵ [0.0, 1.0] |

## 3D Helix

|  |  |
| --- | --- |
| **Major Arc of Ellipse** | **Parametric Equation** |
|  | x = cos(6\*u\*pi);  y = sin(6\*u\*pi);  z = u;  u ϵ [0.0, 1.0] |

# Task 2: Convert y = sin(x) Into Parametric Representation

|  |  |
| --- | --- |
| **Sin Curve** | **Parametric Equation** |
|  | x = u;  y = sin(4\*u\*pi);  z = 0;  u ϵ [-1.0, 1.0] |

# Task 3: Explore What Happens When Curve Resolution Are Changed

The curve resolution will determine the number edges the polygon will have. When it is 100, a circle will look smooth, as the curve resolution decreases, the circle will start to look rougher. With curve resolution being 10, a circle will become a decagon and with it being 3 it will look like a triangle.

With resolution being 2 and below the shape will not appear, this is because no shape can be formed 2 or less edges. They will just appear as a straight line theoretically.

Below are some snapshots with different curve resolution.

|  |  |
| --- | --- |
| **Circle (50 resolution)** | **Circle (10 resolution)** |
|  |  |

|  |  |
| --- | --- |
| **Circle (3 resolution)** | **Circle (2 resolution)** |
|  |  |

|  |  |
| --- | --- |
| **2D Spiral (4 resolution)** | **Sin Curve (10 resolution)** |
|  |  |

# Task 4: Change Curve Parameters

## Straight Line Parameters

For straight lines, changing the parameters will either lengthen or shorten the line.

|  |  |
| --- | --- |
| **Straight Line (Lengthen)** | **Parametric Equation** |
|  | x = u;  y = u;  z = 0;  u ϵ [-3, 3] |

|  |  |
| --- | --- |
| **Straight Line (Shorten)** | **Parametric Equation** |
|  | x = u;  y = u;  z = 0;  u ϵ [0, 0.5] |

## 2D Spiral Parameters

For circles and ellipse, we have seen that having different parameters will produce different arcs of circle or ellipse in Task 2.

For 2D Spiral, the number of rotations and length will increase or decrease accordingly with the parameters

|  |  |
| --- | --- |
| **2D Spiral (Lengthen)** | **Parametric Equation** |
|  | x = u\*cos(6\*u\*pi);  y = u\*sin(6\*u\*pi);  z = 0;  u ϵ [0.0, 2.0] |

|  |  |
| --- | --- |
| **2D Spiral (Shorten)** | **Parametric Equation** |
|  | x = u\*cos(6\*u\*pi);  y = u\*sin(6\*u\*pi);  z = 0;  u ϵ [0.0, 0.5] |

## Sin Curve Parameters

For a sin curve, the parameters will determine how many full rotations it will be make to the negative side or negative side of x-axis.

|  |  |
| --- | --- |
| **Sin Curve (Positive)** | **Parametric Equation** |
|  | x = u;  y = sin(4\*u\*pi);  z = 0;  u ϵ [0.0, 2.0] |

|  |  |
| --- | --- |
| **Sin Curve (Negative)** | **Parametric Equation** |
|  | x = u;  y = sin(4\*u\*pi);  z = 0;  u ϵ [-2.0, 0] |