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| Nanyang Technological University |
| Lab 2 Report: Parametric Curves |
| CZ2003 Computer Graphics and Visualization |
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Lab2 report

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| **Parametric Curve** | **Screenshot** | **Notes** |
| Straight line segment A |  | Parametric definition of a straight line segment:  x = x1 + u (x2 – x1)  y = y1 + u (y2 – y1)  u = [0,1]  The origin (0,0) is the starting point and the line ends at point (1,1).  definition "x=0 + (1-0)\*u;  y=0 + (1-0)\*u;  z=0;"  parameters [0 1]  Since z=0, the line is only on the x and y-axis.  The Magnitude of the line is . |
| Straight line segment B |  | definition "x=-1 + (1-(-1))\*u;  y=-2 + (2-(-2))\*u;  z=0;"  The line segment is from coordinates (-1, -2) to coordinates (1,2).  The resolution is now set to [10] and has no effect on the line because this is just one single line. |
| Straight line segment C |  | definition "x= -1 + (1-(-1)) \* u;  y= 1 + (-1-1) \* u;  z= 0;"  parameters [0 2]  The line segment starts from point (-1, 1) and ends at (-3,3) because I changed the parameter domain from [0 1] is [0 2]  When u=2, x = -1 + (2)(2)  y = 1 + (-2)(2) |
| Circle A |  | definition "x=1 \* cos(u\*2 \* pi);  y=1 \* sin(u\*2 \* pi);  z=0;"  parameters [0 1]  resolution [100]  The circle is of radius 1.  it is one full circle because the when u=1, cos(u\*2\* pi)  definition "x=1 \* cos(u \* pi);  y=1 \* sin(u \* pi);  z=0;" produces a similar circle  parameters [-1 1]  resolution [100]  2D circle parametric representation:  x = rcos(θ) + x0  y = rsin(θ) + y0  where r is the radius and  (x0, y0) is the circle centre. |
| Circle B |  | definition "x=1 \* cos(u\* 2\* pi);  y=1 \* sin(u\* 2\* pi);  z=0;"  parameters [0 1]  resolution [10]  When the resolution decreases from resolution from [100] to [10],  a 10-sided polygon is displayed instead of a circle.  This other definition also produces the same figure:  definition "x=1 \* cos(u\* 2\* pi);  y=1 \* sin(u\* 2\* pi);  z=0;"  parameters [0 10]  resolution [100] |
| Circle C |  | definition "x=1 \* cos(u\* 2\* pi);  y=1 \* sin(u\* 2\* pi);  z=0;"  parameters [0 20]  resolution [100]  A 5-sided polygon is produced instead of a 10-sided polygon. When the upper bound of the parameters is doubled, the number of polygon sides halves. |
| Arc A |  | definition "x=2 \* cos(u \* pi);  y=2 \* sin(u \* pi);  z=0;"  parameters [0 1]  resolution [100]  This is a semi-circle arc of radius 2. when u=1, u \* pi where pi is 180 degrees, hence the arc is 180 degrees |
| Arc B |  | definition "x=1 \* cos(u \* pi);  y=1 \* sin(u \* pi);  z=0;"  parameters [-0.25 0.25]  resolution [100]  The radius is now one and lies of the xy plane 1 and the parameters is now from -0.25 to 0.25. the angle from -pi/4 and pi/4 is 90 degrees, hence the 90 degrees arc  Cos(-0.25 \* pi) = 0.707  Sin(-0.25\*pi) = -0.707  Cos(0.25\*pi) = 0.707  Sin(0.25 \* pi) = 0.707  The top point of the arc is at coordinate (0.707, 0.707) and the bottom point of the arc is at coordinate (0.707, -0.707). |
| Arc C |  | definition "x=1 \* cos(1+ u \* pi);  y=1 \* sin(1+ u \* pi);  z=0;"  parameters [0 1]  resolution [100]  cos(1) = 0.540  sin(1) = 0.841  The semicircle arc in Arc A got translated by 0.540 in the x-direction and 0.841 in the y-direction. |
| Arc D |  | definition "x=1 \* cos(u \* pi);  y=1 \* sin(u \* pi);  z=0;"  parameters [-0.25 0.25]  resolution [2]  The sampling resolution of 2 is resulted in the kink. |
| Ellipse A |  | definition "x=2 \* cos(u \* pi);  y=1 \* sin(u \* pi);  z=0;"  parameters [-1 1]  resolution [100]  Radius in the x direction was increased to 2 because the coefficient in the x equation is 2 so that it is stretched out in the x direction. |
| Ellipse B (arc) |  | definition "x=2 \* cos(u \* pi);  y=1 \* sin(u \* pi);  z=0;"  parameters [0 0.5]  resolution [100]  The parameters decreased by 0.5 and this resulted arc arc of the ellipse. |
| Ellipse C |  | definition "x=2 \* cos(u \* pi);  y=1 \* sin(u \* pi);  z=0;"  parameters [-1 1]  resolution [5]  The resolution is decreased from 100 to 5, hence the 5 kinks. |
| Ellipse D |  | definition "x=2 \* cos(u \* pi);  y=1 \* sin(u \* pi);  z=0;"  parameters [-1 1]  resolution [20]  The resolution is now increased to 20 and ellipse is now smoother than previously. |
| 2D\_helix |  | definition "x=u \* cos(u \* pi \* 5);  y=u \* sin(u \* pi \* 5);  z=0;"  parameters [0 1]  resolution [100]  Using 5 instead of 2 will produce 2.5 rounds of spiral which is produced by the increasing u parameter before the sin/cos.  The sampling resolution of 100 is used. |
| 2dhelixA |  | definition "x=u \* cos(u\*pi \* 10);  y=u \* sin(u \*pi \* 10);  z=0;"  parameters [0 1]  resolution [100]  The values in sin and cos is doubled from 5 to 10, so the number of spirals is also doubled.  The edges are getting more uneven and rougher when number of spirals increases while keeping the resolution the same. |
| 2dhelixB |  | definition "x=u \* cos(u\*pi \* 10);  y=u \* sin(u\* pi \* 10);  z=0;"  parameters [0 1]  resolution [250]  The resolution is now set to 250. The result is a much smoother helix. |
| 2dhelixC |  | definition "x=u \* cos(u \* pi \* 5);  y=u \* sin(u \* pi \* 5);  z=0;"  parameters [0 2]  resolution [20]  Doubling the parameters from [0 1] to [0 2] doubles the number of cycles.  In this case, 20 divided by 5 cycles results in 4 points drawn for each cycle per spiral of helix.. |
| 3dhelixA |  | definition "x=u \* cos(u \*pi \*10);  y=u \* sin(u \*pi \* 10);  z=-2 + u \* (1-(-2));"  parameters [0 1]  resolution [200]  Because z = -2 + u\*(1-(-2)), the helix runs from -2 to 1 along the z axis as u ranges from 0 to 1. |
| 3dhelixB |  | definition "x=u \* cos(u\*pi \* 10);  y=u \* sin(u \*pi \* 10);  z=-1 + u;"  parameters [0 1]  resolution [20]  Resolution decreased to 20, the helix becomes squarisg for each cycle instead of looking like a circle. With resolutions reduces to 20 and there are 5 spirals, the points per cycle is 20/5=4, hence the square. |
| 3dhelixC |  | definition  "x=(1+u\*(0.2-1)) \*cos(u\*pi\* 10); y=(1 + u\*(0.2-1)) \*sin(u\*pi \*10); z=-2 + u \* (1-(-2));"  parameters [0 1]  resolution [200]  (1+u\*(0.2-1)) equation in x and y, the helix’s radius now grows from 1 to 0.2. Previously, the helix’s radius grows larger along the positive z-axis direction. Now in shrinks instead. |
| sineCurveA |  | definition "x=u;  y=sin(u\*2\*pi);  z=0;"  parameters [0 1]  resolution [100]  With the parameter ranging from 0 to 1, the sine is a full curve. |
| sineCurveB |  | definition "x=u;  y=(1+ u\* (0.2-1)) \*sin(u\*pi\* 10);  z=0;"  parameters [0 1]  resolution [200]  The sine curve decreases in amplitude from 1 to 0.2 along the positive x direction. |
| sineCurveC |  | definition "x=u;  y=(1 + u\*(0.2-1)) \*sin(u \*pi \* 5);  z=0;"  parameters [0 1]  resolution [2]  Resolution 2 reduces the smoothness of the curve and there is 1 kink. |
| sineCurveD |  | definition "x=u;  y=(1 + u\*(0.2-1))\* sin(u \*pi \* 5);  z=0;"  parameters [-2 1]  resolution [200]  The amplitude of the sine curve decreases along the positive x axis from -2 to 1. The amplitude decreases from 2.6= 1+(-2)(-0.8) to 0.2. |
| sineCurveE |  | definition "x=u \* t;  y=(1 + u \* (0.2-1)) \* sin(u \* pi \* 5 \* t) ;  z=0 + u \* (1-0) \* t;"  parameters [0 1]  resolution [200]  The t is the time parameter for animation. The sine curve will grow from high amplitude to low amplitude. |