**NANYANG TECHNOLOGICAL**

**UNIVERSITY**

**CZ2003**

**COMPUTER GRAPHICS**

**AND**

**VISUALIZATION**

**Labs Assessment**

**Lab 2: Parametric Curve**

**Report**

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***\*Note: All .wrl files are found in Lab 2 🡪 Files.***

**Tasks: Defining different shapes parametrically and explore how resolutions and parameter affects the shapes.**

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| **Defined Shape:** Straight Line Segment  **File Name:** Straight\_Line\_Segment | |
| **Resolution = [100]; Parameter = [0 1]**  To define a Straight Line Segment curve, the following parametric equation is used:  x = u;  y = u;  z = 0;  Resolution and Parameter values remains as the default given values in this scenario. | C:\Users\mock_\Desktop\Yr 3 Sem 1 Modules\CZ2003 Computer Graphics & Visualisation\Labs\Lab 2\Straight_Line_Segment_R100.PNG  ***\*Dig.1*** |
| **Resolution = [5]; Parameter = [0 1]**  To explore how resolution will affects the shape of a Straight Line Segment curve, the resolution value is **changed from [100] to [5]**. Parameter values remains the same.  As seen from the diagram beside, a change in the resolution value will not affects the shape of the curve. Values such as [1] and [8] were also used to further explore if the shapes will get affected by the resolution value. Same results were produced regardless of the resolution value. Hence, it can be concluded that resolution value will not affects the shape of the curve.  *\*Refer to Lab2🡪Diagrams🡪Straight Line Segment🡪 Straight\_Line\_Segment\_R1/ Straight\_Line\_Segment\_R8 to view other diagrams with different resolution value ([1] [8])* | C:\Users\mock_\Desktop\Yr 3 Sem 1 Modules\CZ2003 Computer Graphics & Visualisation\Labs\Lab 2\Straight_Line_Segment_R100.PNG  ***\*Dig.2*** |
| **Resolution = [100]; Parameter = [0 3]**  In this scenario, the diagram besides shows a curve that has a **parameter of [0 3]** and resolution of [100].  Unlike the curve that has a parameter of [0 1], the straight line in the curve of parameter [0 3] gets elongated. Further changes to other value such as [0 4] [0 5] will shows that the straight line in the curve will scale accordingly to the value in the parameter. The bigger the value, the more the line will elongate and vice versa.  *\*Refer to Lab2🡪Diagrams🡪Straight Line Segment🡪 Straight\_Line\_Segment\_P4/ Straight\_Line\_Segment\_R5 to view other diagrams with different parameter values ([0 1] [0 8])* | ***\*Dig.3*** |
| **Defined Shape:** Circle  **File Name:** Circle | |
| **Resolution = [100]; Parameter = [0 1]**  A Circle can be defined by the following equations:  x = cos(2\*pi\*u);  y = sin(2\*pi\*u);  z = 0;  The diagram beside shows a Circle with a **Resolution of [100]** and **Parameter of [0 1]**. | ***\*Dig.4*** |
| **Resolution = [8]; Parameter = [0 1]**  The diagram at the side shows a Circle that has a **resolution value of [8]** and parameter of [0 1].  Various resolution values (E.g. 15 and 6) were used to observe how the Circle will get affected by changes the resolution value. Based on the observation made, it can be seen that as the resolution value gets reduced, the points that connects the separate lines will become more visible. In this case, when the resolution value is [8], it can be clearly seen that there are 8 points on the Circle that connects the different lines together. This is not seen in the resolution value of [100] as the points were closely located to each other and it is not visible on the diagram. Thus, resulting in a smooth Circle as shown above. | ***\*Dig.5***  *\*Refer to Lab2🡪Diagrams🡪Circle🡪 Circle\_R15/Circle\_R6 to view other diagrams with different resolution values ([6] [15])* |
| **Resolution = [100]; Parameter = [0 5]**  When the **parameter value** of the Circle has been change to **[0 5]**, it will result in a Circle that is shown at the diagram beside.  As seen, the Circle here is no longer a smooth circular shape. This is mainly due to the changes made in the parameter value. When changes are made to the parameter, the number of rotation for the Circle will elongate or shorten accordingly to the magnitude of the value. This observation can be observed when other parameter value such as [0 3] or [0 12] is used.  *\*Refer to Lab2🡪Diagrams🡪Circle🡪 Circle\_P3/Circle\_P12 to view other diagrams with different parameter values ([0 3] [0 12])* | ***\*Dig.6*** |
| **Defined Shape:** Circle Arc  **File Name:** Circle\_Arc | |
| **Resolution = [100]; Parameter = [0 1]**  To obtain a Circle Arc curve, the following equation is defined:  x = cos(pi\*u);  y = sin(pi\*u);  z = 0;  The Circle Arc is defined with a **resolution value of [100]** and **parameter value of [0 1].** | ***\*Dig.7*** |
| **Resolution = [4]; Parameter = [0 1]**  In this scenario, the **resolution value** for the Circle Arc is changed to **[4]**, while the parameter value remains the same. A curve as shown beside is the result of the changes made.  Similar to the observation on Dig.5 above, the resolution value will have a direct impact on the visibility of the points connecting the lines. For this case, since the resolution value is [4], 4 points can be seen clearly in the diagram.  *\*Refers to Dig.5 for more detailed explanation* | ***\*Dig.8*** |
| **Resolution = [100]; Parameter = [0 1.5]**  Dig.9 shows the Circle Arc when the **parameter values** gets changed to **[0 1.5]**.  The Circle Arc here gets elongated to 1.5 from the original value of 1, resulting in the diagram show at Dig.9. This is due to the same observation made in Dig.6, where it is stated that the changes in the parameter value will affects the number of rotation made by the curve.  *\*Refers to Dig.6 for more detailed explanation* | ***\*Dig.9*** |

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| **Defined Shape:** Ellipse  **File Name:** Ellipse | |
| **Resolution = [100]; Parameter = [0 1]**  The equation below is used to define an Ellipse curve shape:  x = 1\*cos(2\*pi\*u);  y = 0.5\*sin(2\*pi\*u);  z = 0;  **Resolution value of [100]** and **parameter value of [0 1]** is used to produce Dig.10**.** | ***\*Dig.10*** |
| **Resolution = [8]; Parameter = [0 1]**  Dig.11 is produced when the **resolution value** of the Ellipse curve is changed to **[8]**. Parameter value in this case remains the same ([0 1]).  Similar to Dig.5, as the resolution value gets changed to [8], 8 points that connects the lines will be visible on the Ellipse curve. With the reduction of the resolution value, the Ellipse curve is no longer has a smooth rounding shape.  *\*Refers to Dig.5 for more detailed explanation* | ***\*Dig.11*** |
| **Resolution = [100]; Parameter = [0 15]**  To explore the effects of changing the **parameter value** of an Ellipse curve, the value of the parameter is changed to **[0 15]** and the result is shown in Dig.12.  When the parameter is changed to [0 15], the Ellipse curve will elongate and rotate accordingly to the value, hence resulting a “messy” curve in Dig.12. The reason behind such observation is similar to the one made on Dig.6.  *\*Refers to Dig.6 for more detailed explanation* | ***\*Dig.12*** |

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| **Defined Shape:** Ellipse Arc  **File Name:** Ellipse\_Arc | |
| **Resolution = [100]; Parameter = [0 1]**  A Ellipse Arc can be defined by the following definition:  x = cos(pi\*u);  y = 0.5\*sin(pi\*u);  z = 0;  The Ellipse Arc is defined with a **resolution value of [100]** and **parameter value of [0 1].** | ***\*Dig.13*** |
| **Resolution = [5]; Parameter = [0 1]**  For this scenario, a **resolution value of [5]** is used to explore the effects of resolution on the Ellipse Arc curve.  Similar to Dig. 5, 8, 11, it is observed that the resolution value will affects the visibility of the points that connects the lines together. When the resolution value is [5], the Ellipse Arc curve will shows 5 points that made up the shape.  *\*Refers to Dig.5 for more detailed explanation* | ***\*Dig.14*** |
| **Resolution = [100]; Parameter = [0 1.5]**  Dig.15 shows the changes to the Ellipse Arc curve when the **parameter values** gets changed to **[0 1.5]**.  As mentioned in Dig.6, the parameter values will have an impact on the number of rotation made by the curve. Since the value here is [0 1.5], the corresponding rotation shown in Dig.15 is made. | ***\*Dig.15*** |

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| **Defined Shape:** 2D Spiral  **File Name:** 2D\_Spiral | |
| **Resolution = [100]; Parameter = [0 1]**  A 2D Spiral curve can be obtained by the equation:  x = u\*cos(4\*pi\*u);  y = u\*sin(4\*pi\*u);  z = 0;  **Resolution** and **parameter value** of Dig.12 is **[100]** and **[0 1]** respectively. | ***\*Dig.16*** |
| **Resolution = [20]; Parameter = [0 1]**  When the **resolution value** for a 2D Spiral is changed to **[20]**, a curve that is seen in Dig. 17 will be produced.  Instead of a smooth rotating spiral, the 2D spiral has been changed into an uneven rotating curve to reflect the new resolution value of [20]. The reason why a new resolution value will affects the shape of the 2D spiral is the same as the reason behind Dig. 5, 8, 11 and 14. | ***\*Dig.17*** |
| **Resolution = [100]; Parameter = [0 2]**  Changing the **parameter value** to **[0 2]** will cause the original 2D spiral curve to change into the one that is displayed in Dig.18  As mentioned previously in Dig.6, the parameter value will determine the number of rotation made by the curve. The rotation made by the 2D Spiral will be more obvious as compared to the previous diagrams due to it being a spiral shape. Therefore, in this scenario, it can be clearly seen that when the parameter is [0 2], the 2D spiral has made 2 rotation along the xy axis.  To further strengthen the point made in Dig.6, other parameter value such as [0 3], [0 5] were used on the 2D spiral curve. The corresponding rotations (3, 5) are made by the 2D spiral. | ***\*Dig.18***  *\*Refer to Lab2🡪Diagrams🡪2D Spiral🡪 2D\_Spiral\_P3/2D\_Spiral\_P5 to view other diagrams with different parameter values ([0 3] [0 5])* |
| **Defined Shape:** 3D Helix  **File Name:** 3D\_Helix | |
| **Resolution = [100]; Parameter = [0 1]**  The following definition will define a 3D Helix:  x = cos(4\*pi\*u);  y = sin(4\*pi\*u);  z = u;  Dig.19 shows a 3D Helix curve with the resolution value of **[100]** and parameter value of **[0 1]**. | ***\*Dig.19*** |
| **Resolution = [8]; Parameter = [0 1]**  **Resolution value** of **[8]** is used to explore how the resolution value will affects the 3D Helix curve.  As seen in Dig.20, the 3D Helix no longer have the circular rotating curve that it has when the resolution value is [100], instead, a diamond-shaped curve is seen rotating around the z-axis. 8 connecting points were observed in the curve and this is consistent with the observation made in Dig. 5, 8, 11 and 14 and 17. Details on why is there such observation can be found in Dig.5. | ***\*Dig.20*** |
| **Resolution = [100]; Parameter = [0 2]**  To obtain the 3D Helix curve that is shown on Dig.21, the parameter value of the curve is changed to [0 2].  The changes here are more clear and obvious as compared to the other curves which had it parameter value changed. As seen, upon changing the value to [0 2], the 3D Helix starts to rotates towards the z-axis by 2 times. Further changes of the parameter value to [0 3], [0 4] will result in the curve rotating more towards to z-axis.  *\*Refer to Lab2🡪Diagrams🡪3D Helix🡪 3D\_Helix\_P3/3D\_Helix\_P4 to view other diagrams with different parameter values ([0 3] [0 5])* | ***\*Dig.21*** |

**---End of Report---**