Logarithmic Spiral Generation for Smooth Camera Motion

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I. Overview

The logarithmic spiral is a mathematical curve also known as the golden ratio, growth spiral, golden section, and spira mirabilis. It was studied by Descartes and Torricelli in 1638 and again by Jacques Bernoulli 1654-1705. The curve originates as the inverse of an exponential curve. The pattern is found in nature and has been observed for its subjective beauty and aesthetic features. Some examples include plants, spiraled seashells, and many horns of goats, sheep, and other animals.

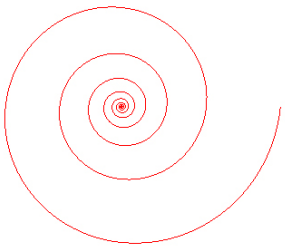


Figure 1: *logarithmic spiral visual example*

$$x = ae^{k\varphi}\cos\varphi, \qquad y = ae^{k\varphi}\sin\varphi$$

Figure 2: *Equation for a logarithmic curve*

II. Requirements

- Use at least two external Python libraries that we have not previously used in class: Panda3D, PyBullet, Numpy
- Implementation using 3D graphics engine: Panda3D
- Reading and writing from files
- A graphical user interface

III. Features

- Dynamic loading of 3D meshes

Figure 3: *Chambered Nautilus, one commonly cited example of naturally occurring logarithmic spiral*

- Dynamic 3D spiral generation with property modification
- GUI: Dynamic user input for affecting curve output attributes (curve height, radius, etc.)
- Animated smooth camera motion based on generated trajectory

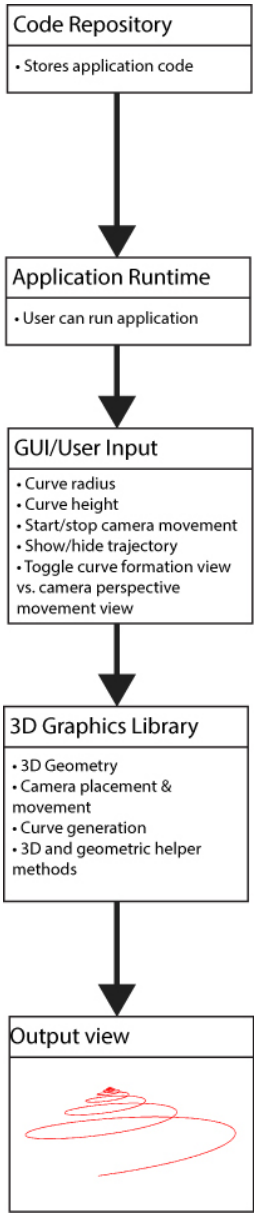
IV. Future Work

- Custom position of loaded mesh
- Custom rotation of loaded mesh
- Export curve for use in other applications
- Add example scenes for more interesting trajectories within the scene

References

[1] Harary, Gur, and Tal, Ayellet. "The Natural 3D Spiral.(Report)." Computer Graphics Forum 30.2 (2011): 237-246. Web.

[2] logarithmic spiral. Accessed 23 June 2020. http://www.2dcurves.com/spiral/spirallo.html



[3] "Spira Mirabilis." American Scientist 102.2 (2014): 141. Web.

[4] Hellmuth Stachel, Giorgio Figliolini, and Jorge Angeles. "THE LOGARITHMIC SPIRAL AND ITS SPHERICAL COUNTERPART." Journal of Industrial Design and Engineering Graphics 14.1 (2019): 91-98. Web.

[5] Bassetto, Marco, Lorenzo Niccolai, Alessandro Quarta, and A. Mengali. "Logarithmic Spiral Trajectories Generated by Solar Sails." Celestial Mechanics and Dynamical Astronomy 130.2 (2018): 1-24. Web.

[4] Robert Dixon. (1983). The Mathematics and Computer Graphics of Spirals in Plants. Leonardo, 16(2), 86-90. doi:10.2307/1574791