ALLO RENZ

ALLORENZ STRANGE ATTRACTOR

MAT 201B - W22

"Strange Attractor"

A region or shape to which points are 'pulled' as the result of a certain process.

The AlLorenz is a 'strange' application simulating the Lorenz, the Den Tsucs, and the Chen - Lee attractors. The presented chaotic systems have 3 or more parameters describing the characteristics of each model.

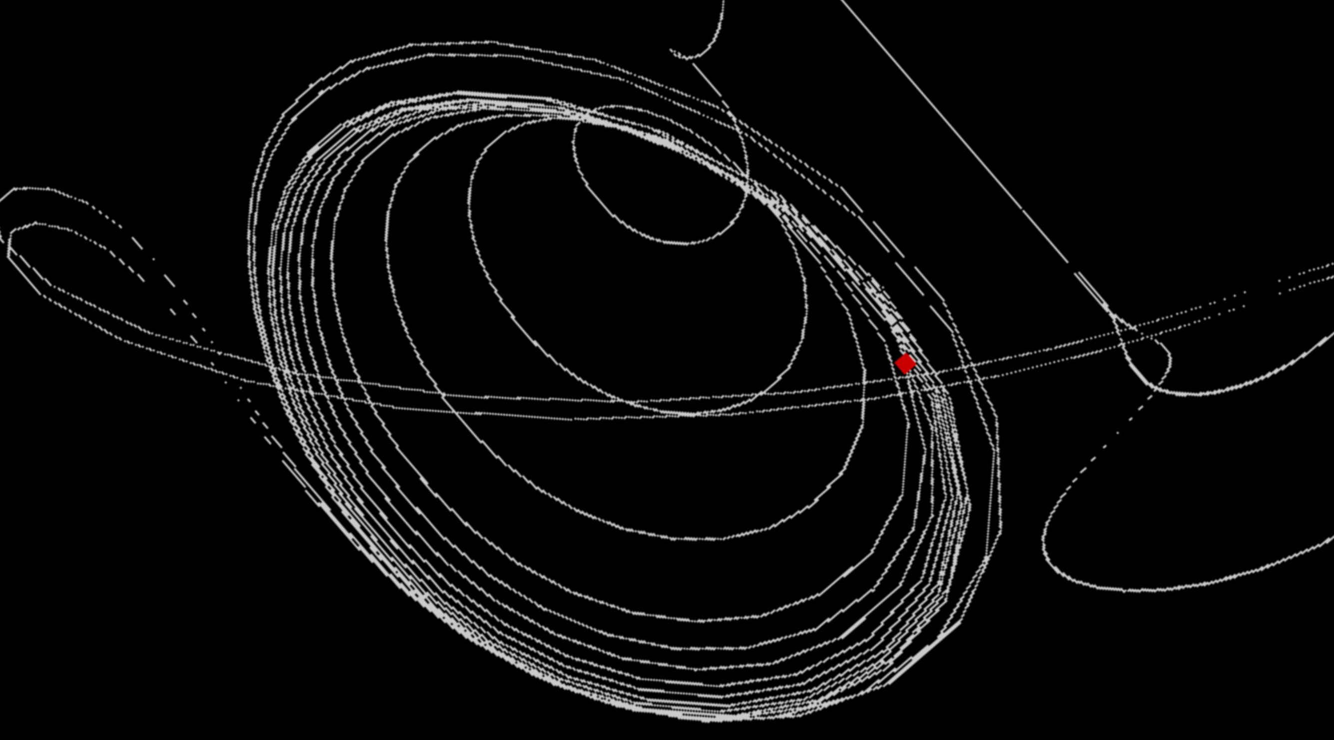
Due to the unique properties of the strange attractors the simulated models never close on themselves – the motion of the system never repeats (non- periodic) – otherwise described as a chaotic behavior.

The Allorenz application has the ability to morph the shaped line between several different attractors and their variables while modulating the frequency of a Low Frequency Oscillator (LFO).

How it works:

Application in C++, based on the Allolib_Playground library. Adapted from the 'Chaotic System' (Karl Yerkes | MAT201B | W22) and including the Gamma engine for the audio component. The original scope was to project this application to the Allosphere, so the code was adapted to the 'al_DistributedScene.hpp' to match the audio and visual requirements of the dynamic platform.

The GUI interface gives the user the opportunity to change each parameter of all four different strange attractors, store different presets with a desired morph time for the transition. In addition, you can shift between the different attractors by pressing from '0' to '3'.



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Lorenz Attractor

Parameters:

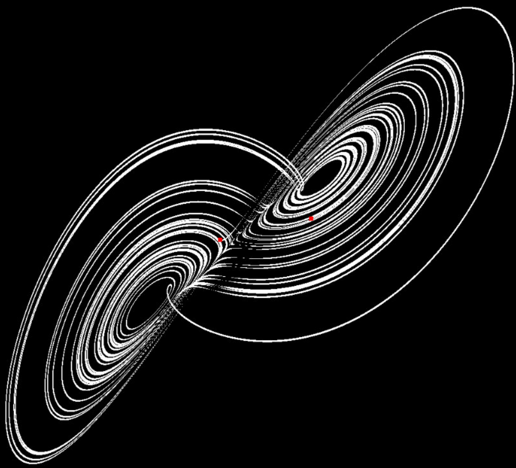
$\sigma = 10, \rho = 28, \beta = 8/3$

System:

$dx / dt = \sigma(-x + y)$

$dy / dt = -xz + \rho x - y$

$dz / dt = xy - \beta z$



Chen - Lee Attractor

Parameters:

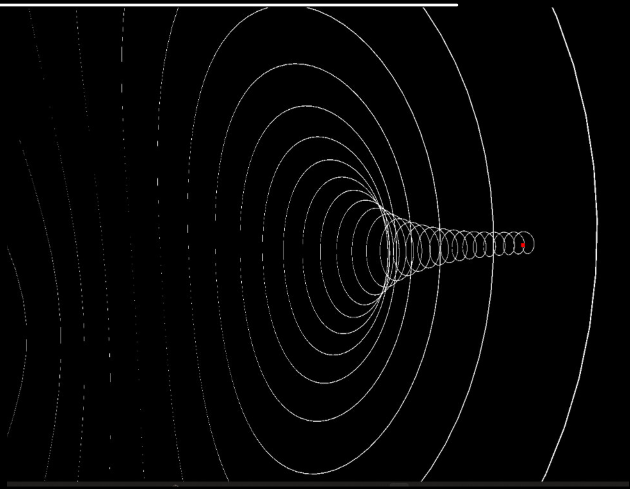
$\alpha = 5, \beta = -10, \delta = -0.38$

System:

$dx / dt = \alpha x - yz$

$dy / dt = \beta y + xz$

$dz / dt = \delta z + x$



Den Tsucs Attractor

Parameters:

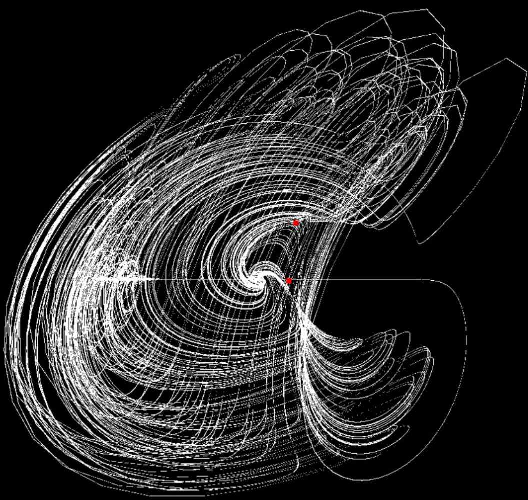
$a = 40, c = 0.833, d = 0.5, e = 0.65, f = 20$

System:

$dx / dt = \alpha(y - x) + dxz$

$dy / dt = fy - xz$

$dz / dt = cz + xy - ex^2$



Modified Lorenz Attractor

Parameters:

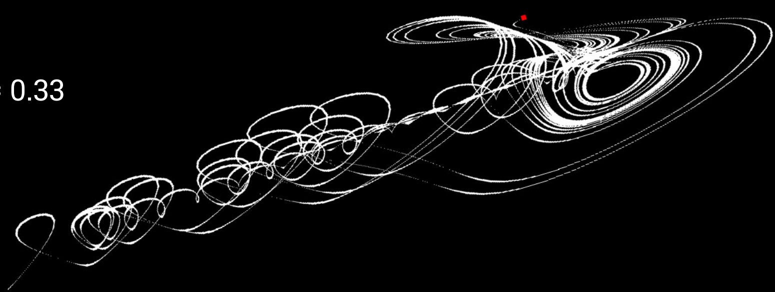
$\rho = 3.94, \sigma = 8.79, \beta = 0.33$

System:

$dx / dt = yz$

$dy / dt = \rho(x-y)$

$dz / dt = (\sigma - \beta)xy - (1 - \beta) x^2$



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Field Questions:

How can we translate mathematical equations into spatial visual and audio real-time compositions?

Can we create an immersive spatial interactive experience with the use of strange attractor equations?

Can we create attractor based musical instruments?

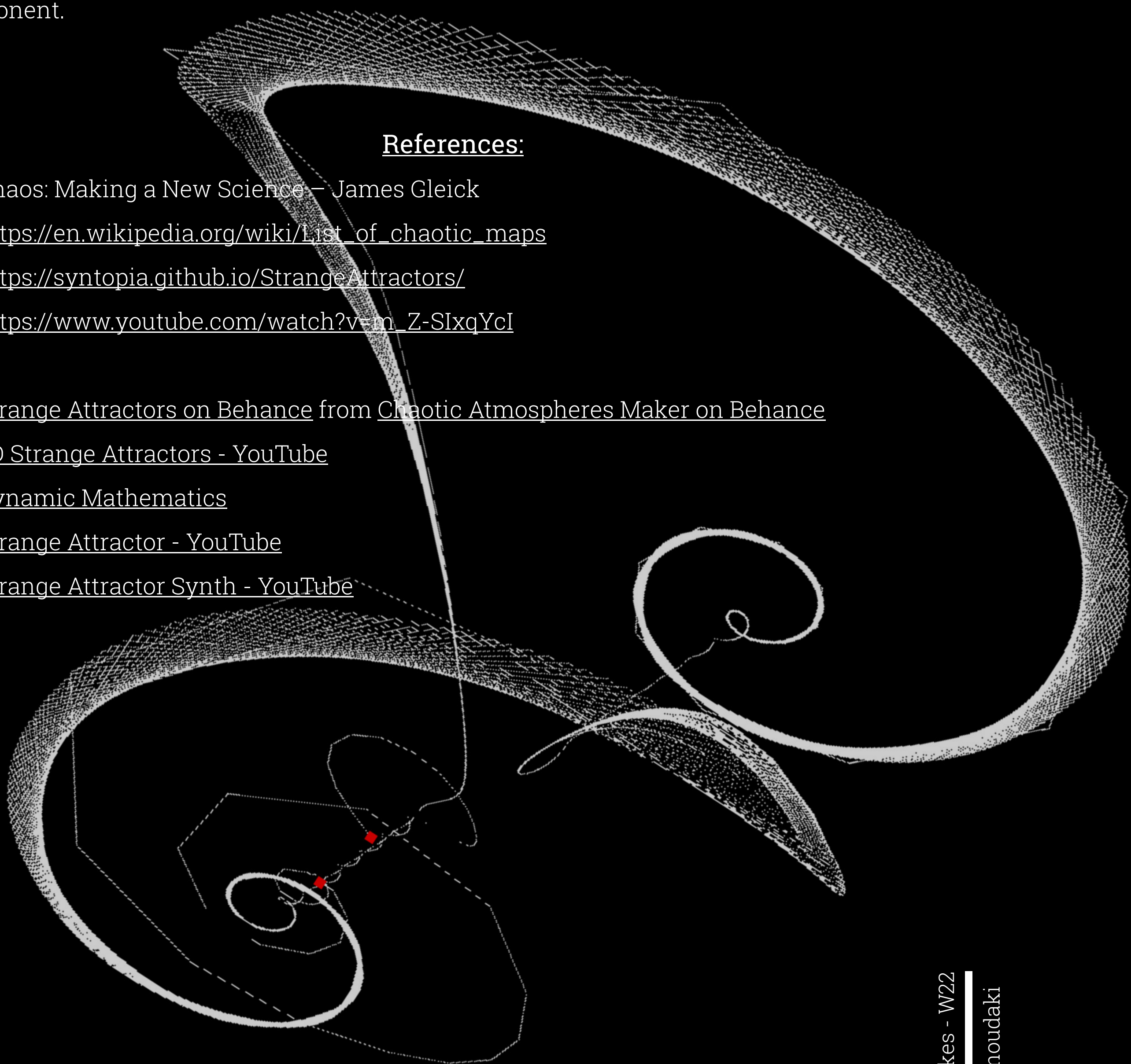
Future work:

This application is a starting point to a multi-modal tool for an immersive experience through Strange Attractors and mathematical equations. The future work on this project is going to focus on the aesthetics (mesh creation, materials and shaders) and the audio synthesis component.

References:

- Chaos: Making a New Science – James Gleick
- https://en.wikipedia.org/wiki/List_of_chaotic_maps
- https://syntopia.github.io/StrangeAttractors/
- https://www.youtube.com/watch?v=m_Z-SIxqYcI

- Strange Attractors on Behance from Chaotic Atmospheres Maker on Behance
- 3D Strange Attractors - YouTube
- Dynamic Mathematics
- Strange Attractor - YouTube
- Strange Attractor Synth - YouTube



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