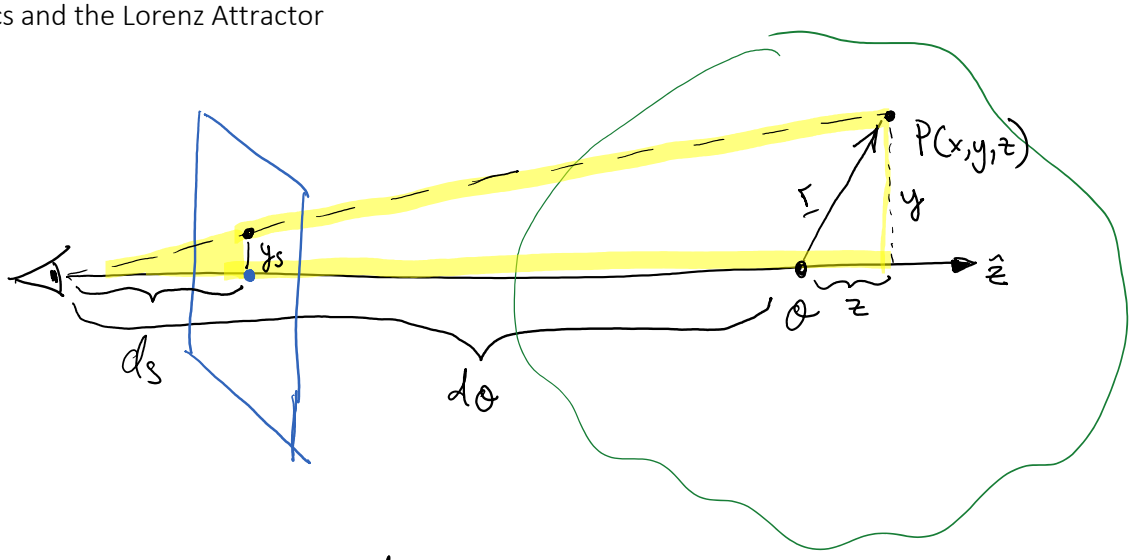
SINS 7: 3-D Graphics and the Lorenz Attractor

28 October 2019 11:56



$$\frac{y_s}{y} = \frac{d_s}{d_0+z} \qquad \frac{x_s}{x} = \frac{d_s}{d_0+z}$$

$$\begin{pmatrix} x_s \\ y_s \end{pmatrix} = \frac{d_s}{d_0+z}\begin{pmatrix} x \\ y \end{pmatrix}$$ Perspective Projection

Rotate the object

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} c & 0 & -s \\ 0 & 1 & 0 \\ s & 0 & c \end{pmatrix}\begin{pmatrix} x \\ y \\ z \end{pmatrix}$$ Rotate about y-axis

$c = \cos\theta$
$s = \sin\theta$

θ is a rotation angle about y-axis.

about x: $\begin{pmatrix} 1 & 0 & 0 \\ 0 & c & s \\ 0 & -s & c \end{pmatrix}$

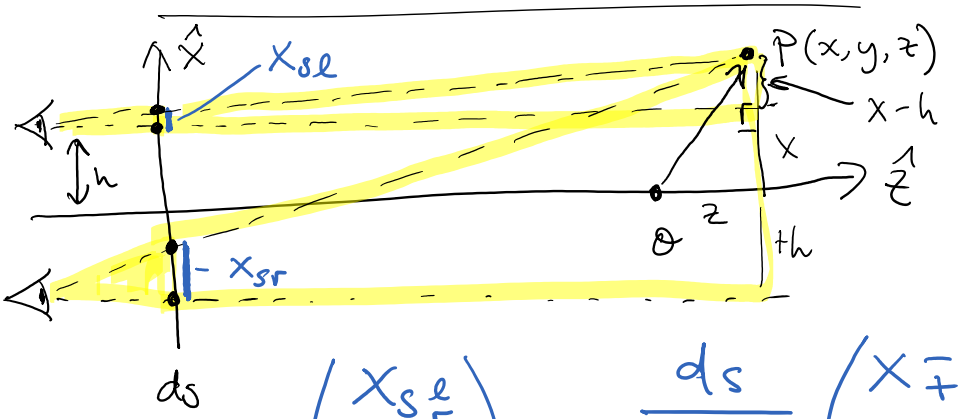
$c = \cos\theta$
$s = \sin\theta$

$t = x*c + z*s$

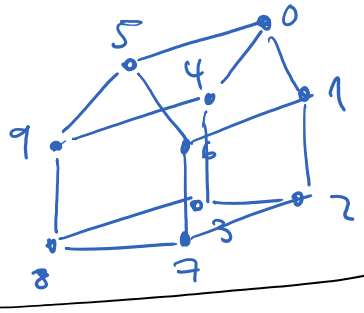
$z = z*c - x*s$

$x = t$

$$z = z*c - x*s$$
$$x = t$$



$$\begin{pmatrix} x_{sl,r} \\ y_s \end{pmatrix} = \frac{d_s}{d_0 + z} \begin{pmatrix} x \mp h \\ y \end{pmatrix}$$

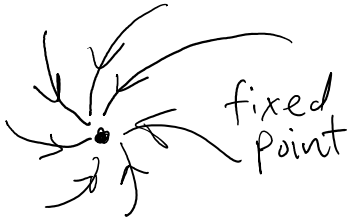


LORENZ - ATTRACTOR: 1962

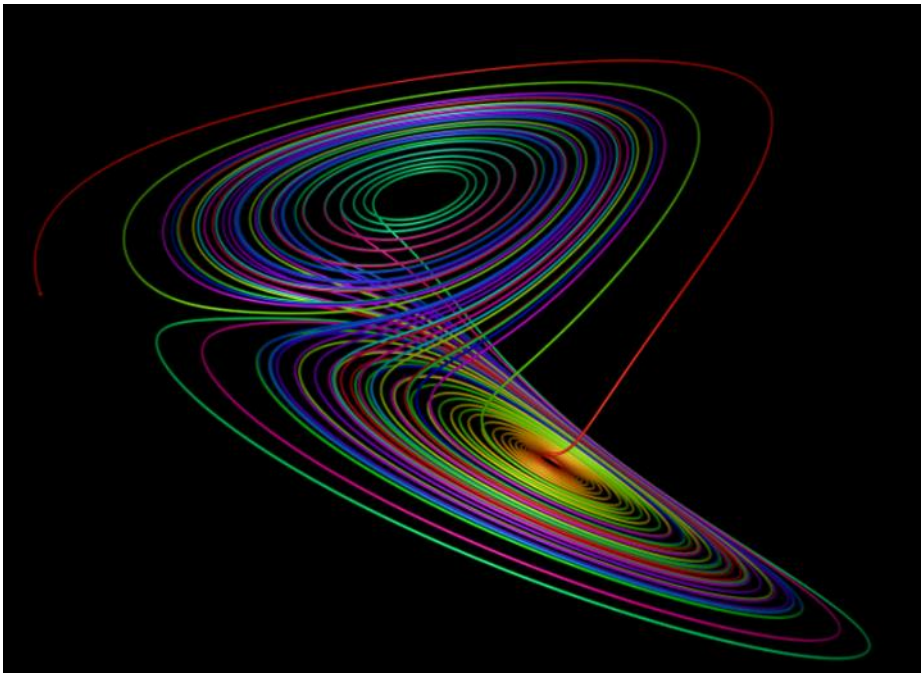
$$\frac{dx}{dt} = -\sigma x + \sigma y$$

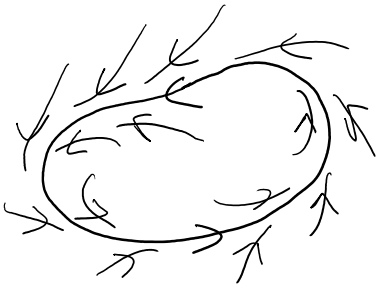
$$\frac{dy}{dt} = \rho x - y - xz$$

$$\frac{dz}{dt} = -\beta z + xy$$

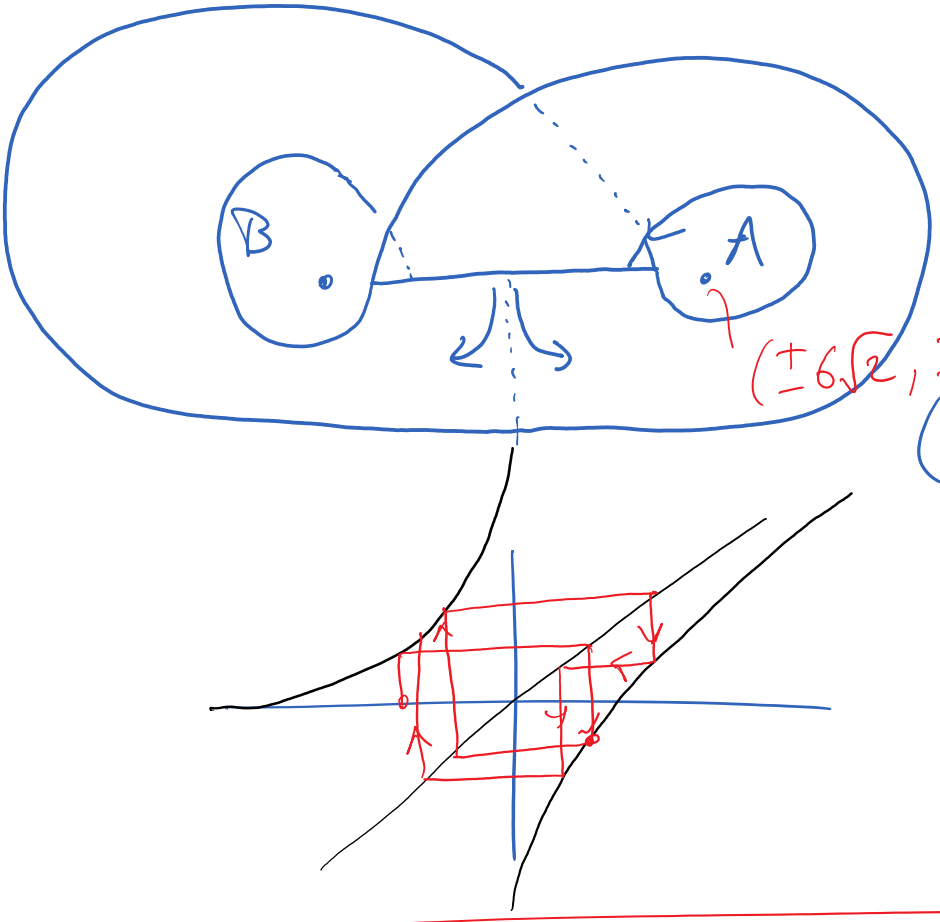


$\sigma = 10$
$\beta = 8/3$
$\rho = 28$





← Strange Attractor



Streatch-
Split-
Merge

$(\pm 6\sqrt{2}, \pm 6\sqrt{2}, 27)$

(AAAB)

Rössler

$$\frac{dx}{dt} = -y - z$$

$$\frac{dy}{dt} = x + ay$$

$$\frac{dz}{dt} = b + z(x - c)$$

$a = 0.2$ $b = 0.2$ $c = 5.7$

$a = 0.1$ $b = 0.1$ $c = 14$