Model Documentation of the Lorentz Attractor

1 Nomenclature

1.1 Nomenclature for Model Equations

x	is proportional to convection motions
y	is proportional to temperature difference between ascending and descending currents
z	is proportional to distortion of vertical temperature profile from linearity
σ	Prandtl Number
r	quotient of Raileigh Number and a critical value (see [**?**])
b	parameter

2 Model Equations

State Vector and Input Vector:

$$\underline{x} = (x_1\ x_2\ x_3)^T = (x\ y\ z)^T$$
$$\underline{u} = \emptyset$$

Model Equations:

$$\dot{x} = -\sigma x + \sigma y \tag{1a}$$
$$\dot{y} = -xz + rx - y \tag{1b}$$
$$\dot{z} = xy - bz \tag{1c}$$

Parameters: $\sigma,\ r,\ b$
Outputs: *⟨not defined⟩*

2.1 Exemplary parameter values

Parameter Name	Symbol	Value	Range
Raileight coeff	r	28	$(24.74, 99)$
Parameter	b	2.667	-
Prandtl Number	σ	10	-

3 Derivation and Explanation

The Lorenz Attractor is derived from the dynamic of convection currents. It is based on a model of convection currents formulated by Lord Rayleigh.

4 Simulation

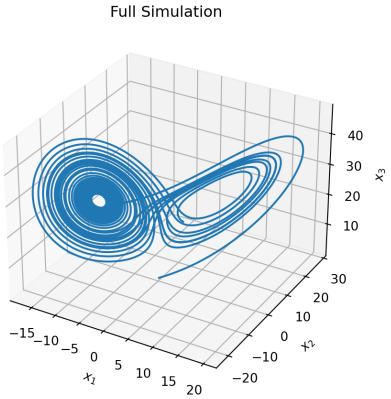

Figure 1: Simulation of the Lorenz System.

References

[1] Lorenz, E. N.: *Deterministic Nonperiodic Flow*, p. 135, Journal of Atmospheric Sciences 1963.