

L-system Visualizer

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Overview

An [L-system](#), or [Lindenmayer system](#) is a type of [rewrite system](#), that applies all rewrite rules simultaneously. The strings generated by L-systems can be used to draw fractals, with each character in the string encoding an instruction: draw forward, turn left, turn right, and more. The recursive nature of L-systems makes them a good pairing with fractals, with each iteration of an L-system representing a greater depth fractal.

How do L-systems Work?

As mentioned above, L-systems apply all rewrite rules simultaneously. As such, while standard rewrite systems could rewrite a symbol into multiple different strings, L-systems only rewrite a given symbol into a single specific string. As an example, an L-system with the following production rules:

- $A \rightarrow AB$
- $B \rightarrow A$

would rewrite ABA to ABAAB:

A	B	A
AB	A	AB

How do L-systems Draw Fractals?

The string generated by an L-system can be used as the instructions for drawing a fractal. Take the [dragon curve](#) as an example. The L-system for the dragon curve has the following properties:

- Start string: F
- Rewrite rules:
 - $F \rightarrow F+G$
 - $G \rightarrow F-G$

Note that + and - are constant symbols, and rewrite to themselves.

Now, read through a generated string. When a given symbol is read, perform the listed action:

- F: draw forward
- G: draw forward
- +: turn left 90°
- -: turn right 90°

Other Fractals

Sierpiński Triangle

The curve approximation of the Sierpiński triangle can be drawn with the following L-system:

- Start string: A
- Rewrite rules:
 - $A \rightarrow B-A-B$
 - $B \rightarrow A+B+A$

Drawing rules:

- A: draw forward
- B: draw forward
- +: turn left 60°
- -: turn right 60°

Koch snowflake

The Koch snowflake can be drawn with the following L-system:

- Start string: $F++F++F$
- Rewrite rule: $F \rightarrow F-F++F-F$

Drawing rules:

- F: draw forward
- +: turn left 60°
- -: turn right 60°

Fractal Plant

A fractal plant can be drawn with the following L-system:

- Start string: X
- Rewrite rules:
 - $X \rightarrow F+[[X]-X]-F[-FX]+X$
 - $F \rightarrow FF$

Drawing rules:

- F: draw forward
- X: do nothing
- +: turn left 25°
- -: turn right 25°

- [: log the current position and angle
-] : set position and angle to the last logged values, then delete those values (in otherwords, treat the log as a stack and pop the stack)

This fractal introduces a new idea of logging position and angle, then returning to the logged position and angle. Most literature will refer to this as the stack of positions and angles. As such, popping the stack means to return to the position and angle at the top of the stack, then deleting said values.