

Lindenmayer Systems: Implementation

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Deterministic Examples

What follows are several deterministic L-systems from various sources.

As you write your L-system interpreter and rendering engine, remember – a rule of thumb for rendering L-systems is that the drawing takes up the same space on the screen with each level of replacement.

That is, the overall drawing should not get any larger or smaller when a given generation / word re-write is rendered.

Experiment with line-segment lengths and reduction factors such that you follow this rule.

Koch Island

<i>angle</i>	90
<i>axiom</i>	F-F-F-F
<i>rules</i>	F=F-F+F+FF-F-F+F
<i>n</i>	3

Another Koch Construction

<i>angle</i>	90
<i>axiom</i>	-F
<i>rules</i>	F=F+F-F-F+F
<i>n</i>	4

A construction that makes use of movements without drawing

<i>angle</i>	90
<i>axiom</i>	F+F+F+F
<i>rules</i>	F=F+f-FF+F+FF+Ff+FF-f+FF-F-FF-Ff-FFF f=ffffff
<i>n</i>	2

Koch Construction – 1

<i>angle</i>	90
<i>axiom</i>	F-F-F-F
<i>rules</i>	F=FF-F-F-F-F-F+F
<i>n</i>	3

Koch Construction – 2

<i>angle</i>	90
<i>axiom</i>	F-F-F-F
<i>rules</i>	F=FF-F-F-F-FF
<i>n</i>	4

Koch Construction – 3

<i>angle</i>	90
<i>axiom</i>	F-F-F-F
<i>rules</i>	F=FF-F+F-F-FF
<i>n</i>	3

Koch Construction – 4

<i>angle</i>	90
<i>axiom</i>	F-F-F-F
<i>rules</i>	F=FF-F--F-F
<i>n</i>	4

Koch Construction – 5

<i>angle</i>	90
<i>axiom</i>	F-F-F-F
<i>rules</i>	F=F-FF--F-F
<i>n</i>	5

Koch Construction – 6

<i>angle</i>	90
<i>axiom</i>	F-F-F-F
<i>rules</i>	F=F-F+F-F-F
<i>n</i>	4

Koch Construction – 7

<i>angle</i>	90
<i>axiom</i>	A
<i>rules</i>	A=A+B+
	B=-A-B
<i>n</i>	10

Koch Construction – 8

<i>angle</i>	60
<i>axiom</i>	B
<i>rules</i>	A=B+A+B B=A-B-A
<i>n</i>	6

Stochastic Examples

You may wish to work on implementing an L-system interpreter that can handle stochastic systems.

Here are a couple to try; additional information useful for on-screen rendering is given.

Coniferous Tree

<i>length</i>	20
<i>reduction</i>	1.25
<i>x</i>	400
<i>y</i>	200
<i>direction</i>	270
<i>angle</i>	21
<i>axiom</i>	F
<i>rules</i>	F=1/3F[++1F[X]][+2F][-4F][--5F[X]]6F F=1/3F[+1F][+2F][-4F]5F F=1/3F[+1F][-2F][--6F]4F X=1/X
<i>colors (HSB)</i>	1=120,100,61 2=134,97,46 3=145,87,8 4=135,84,41 5=116,26,100 6=151,71,53
<i>n</i>	5

Lightning Bolt

<i>length</i>	100
<i>reduction</i>	1.7
<i>x</i>	250
<i>y</i>	470
<i>direction</i>	270
<i>angle</i>	15
<i>axiom</i>	1F
<i>rules</i>	F=1/X+F[+++F] F=1/Y-F F=1/FF[---F] X=1/F-X X=1/XX[+++F--F] Y=1/F+Y[--F] Y=1/F+Y[++F-F] Y=1/YY
<i>colors (HSB)</i>	1=206, 14, 97
<i>n</i>	6

A Plant-like Form

<i>length</i>	1000
<i>reduction</i>	2
<i>x</i>	100
<i>y</i>	250
<i>direction</i>	0
<i>angle</i>	10
<i>axiom</i>	F
<i>rules</i>	F=1/F+F F=1/F-F F=2/F+++++F
<i>n</i>	8

Deciding What Successor To Apply

Odds are used to determine probabilities.

A forward slash separates the odds for a given rule, and the rule itself. The forward slash should be discarded.

For the “plant-like form”, the first rule has a 25% chance of being applied. The second rule has a 25% chance of being applied. The final rule has a 50% chance of being applied.

Example Code in Swift

If you want to look at one implementation of an L-system interpreter and rendering engine, you can [download this project](#).

Download [this project if you'd rather start with a blank slate in Swift](#).

References

Prusinkiewicz, Przemyslaw, and Aristid Lindenmayer. *The Algorithmic Beauty of Plants*. New York: Springer-Verlag, 1990. Print.

Note:

The above-referenced book is available online, free, in its complete form, at this address:

<http://algorithmicbotany.org/papers/#abop>