L-Systems - Exercise

Problem:

Create an L-system showing a simple color bar where the bar changes color around its midpoint.

Solution:

To set up an L-system for a color bar, we use the rule:

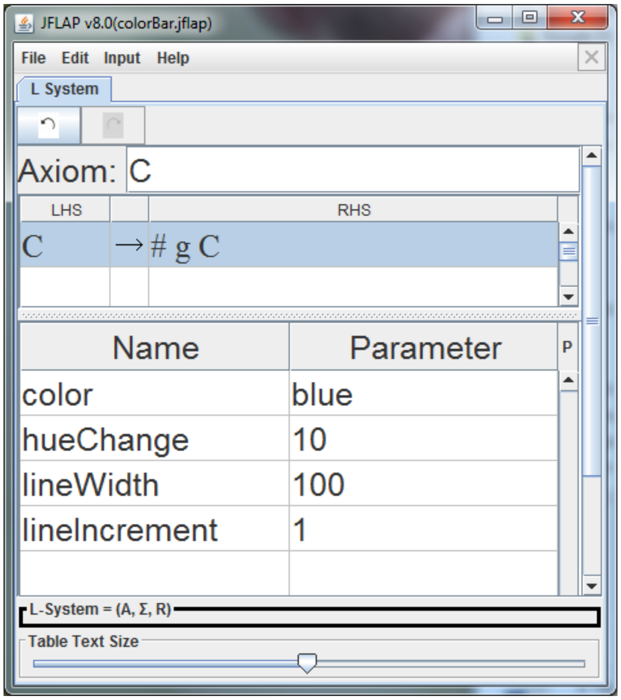
$$C \rightarrow \# \; g \; C$$

Recall that L-systems differ from Chomsky grammars in that all variables are replaced in each step, and not just one. For example, with the replacement rule “C → # g C”, and with an axiom, or initial state, of “C”, the first derivation of the system would be “# g # g”, the second derivation “# g # g # g”, and so on.

Also recall that JFLAP defines an L-system as follows:

- Σ is the finite alphabet of the L-system.
- A ∈ Σ+ of the finite length of the axiom
- R = {(a, b, c) → d | a, c ∈ Σ^*, b ∈ Σ, d ⊂ Σ^*}
- For any (a, b, c) → d ∈ R, if |d| > 1 the L-system is a stochastic L-system, and if a ≠λ or c ≠λ the L-system is a contextual L-system.

To start, open JFLAP and create a new L-system. A new window is presented with an area for the axiom, rule(s), and name-parameter pairs. Enter the values for these fields as shown on the left below.



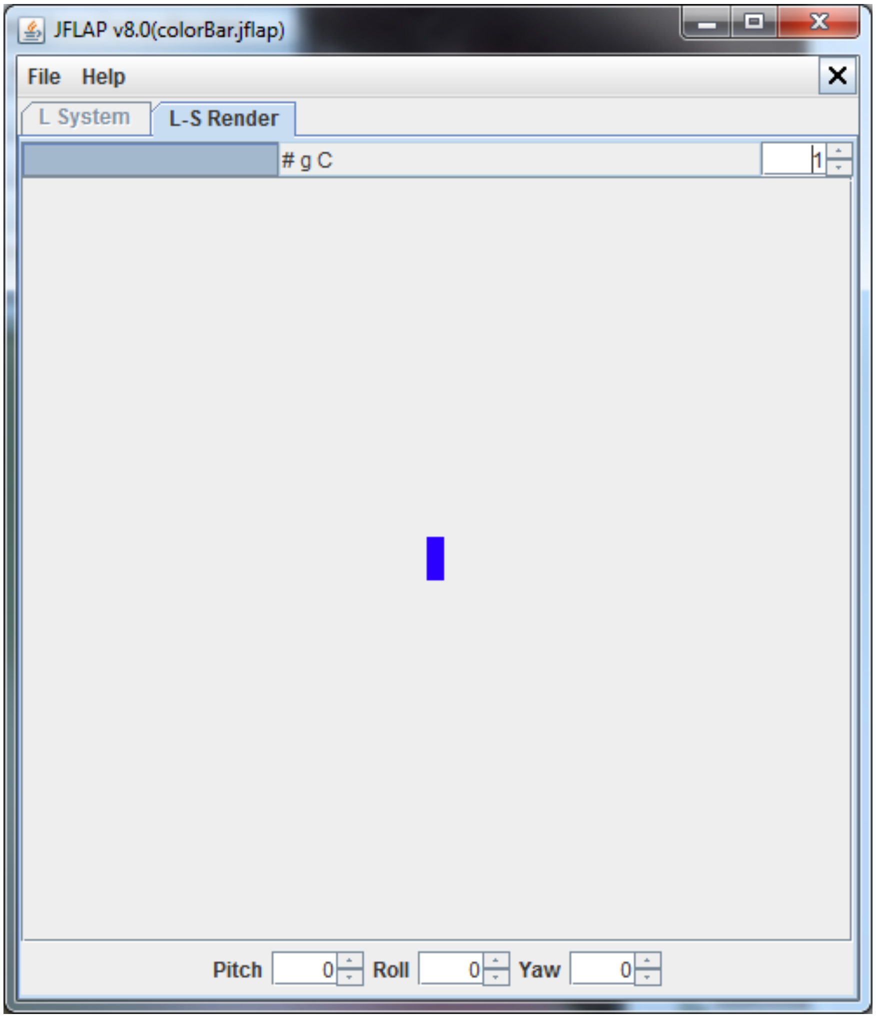
Axiom: C

LHS		RHS
C	→	# g C

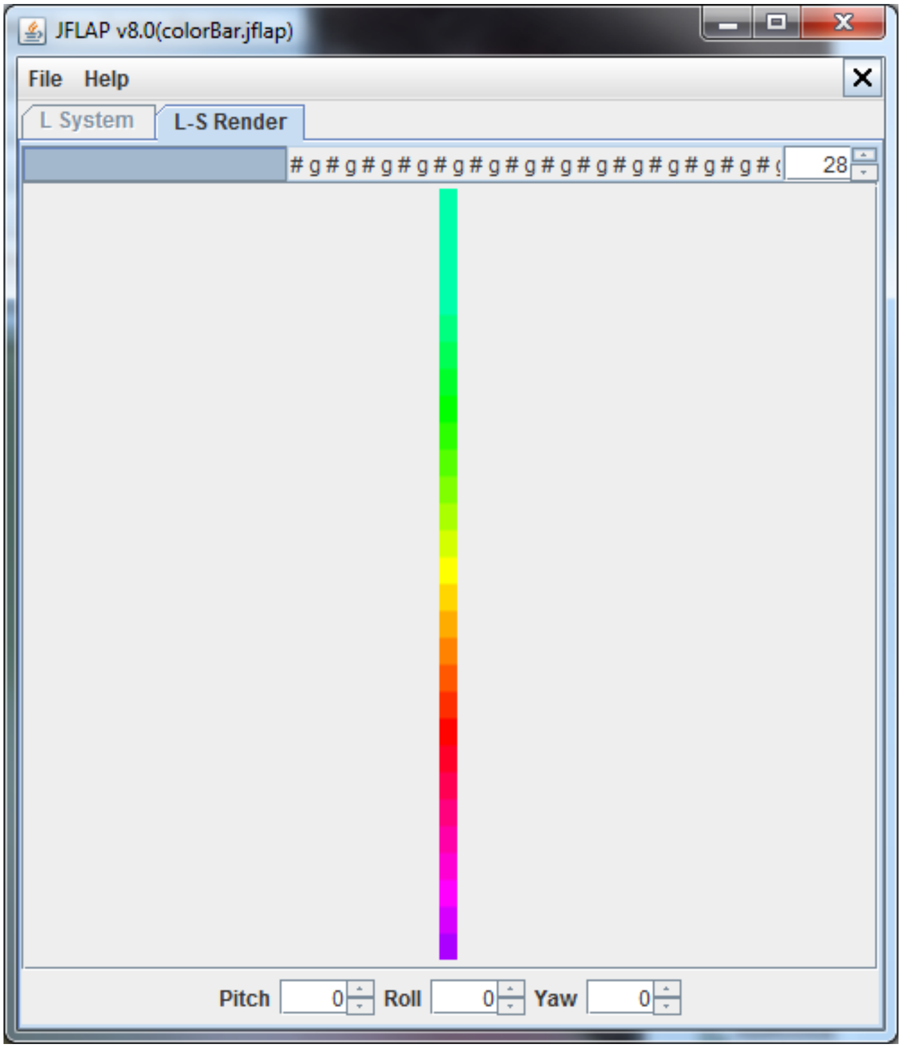
Name	Parameter
color	blue
hueChange	10
lineWidth	100
lineIncrement	1

The Axiom is set to the variable C, which will be replaced with the sequence # g C at each iteration. The color of the line made by the g command is set to blue, which has a value which is not 0 or one, so the hue change will be visible. The # indicates an increment in hue, in this case it is 10 (the default). The g means make a mark of lineWidth 100 and lineIncrement 1.

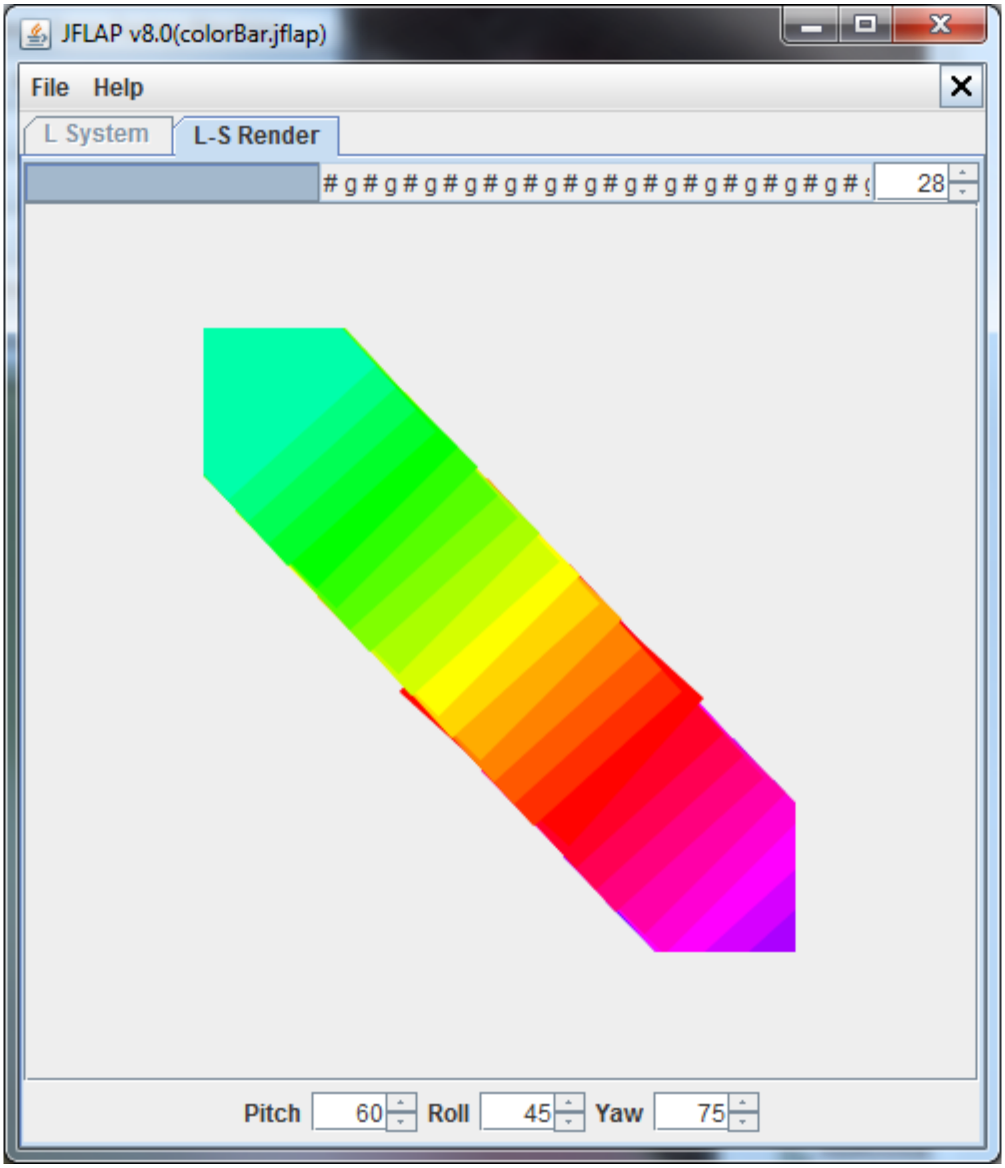
Next, click *Input* > *Render L-System*. A short bar in blue is rendered.



Increase the repetition number using the up-arrow on the upper-right hand side of the window and watch the bar increase in length.



Next, play with the Pitch, Roll, and Yaw values. The "Pitch" will rotate the object around the x-axis, the "Roll" around the y-axis, and the "Yaw" around the z-axis.



g # g # g # g # g # g # g # g # g # g # g # g # g # (

28

Pitch 60

Roll 45

Yaw 75