L-Systems

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Dar-jen Chang

1. L-system Wikipedia
   https://en.wikipedia.org/wiki/L-system

2. LSystemA_NET Windows application

History

An L-system or Lindenmayer system is a formal grammar most famously used to model the growth processes of plant development. It is also able to model the morphology of a variety of organisms. L-systems were introduced and developed in 1968 by the Swedish theoretical biologist and botanist from the University of Utrecht, Aristid Lindenmayer (1925-1989).

L-system

- As a language generation system

An L-system or Lindenmayer system is a parallel rewriting system and a type of formal grammar. An L-system consists of an alphabet of symbols that can be used to make strings, a collection of production rules that expand each symbol into some larger string of symbols, an initial "axiom" string from which to begin construction.

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von Koch snowflake

An L-system to generate the language of von Koch snowflake curves:

The axiom (or start string) :   F

Production: F $\rightarrow$ F-F++F-F

Then the von Koch snowflake strings are generated via parallel substitution of F by the right-hand side of the production iteratively.
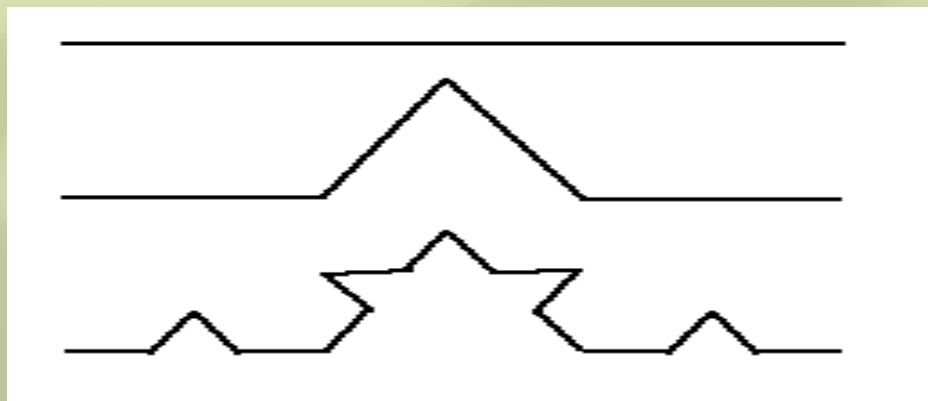
- ## The von Koch snowflakes generation

$\Sigma = \{ +, -, F \}$,

$L = \{ \underline{F}, \ \underline{F\text{-}F\text{++}F\text{-}F}, \ \boxed{F\text{-}F\text{++}F\text{-}F} \ \text{-} \ \boxed{F\text{-}F\text{++}F\text{-}F} \ \text{++} \ \boxed{F\text{-}F\text{++}F\text{-}F} \ \text{-} \ \boxed{F\text{-}F\text{++}F\text{-}F}, \ ... \}$
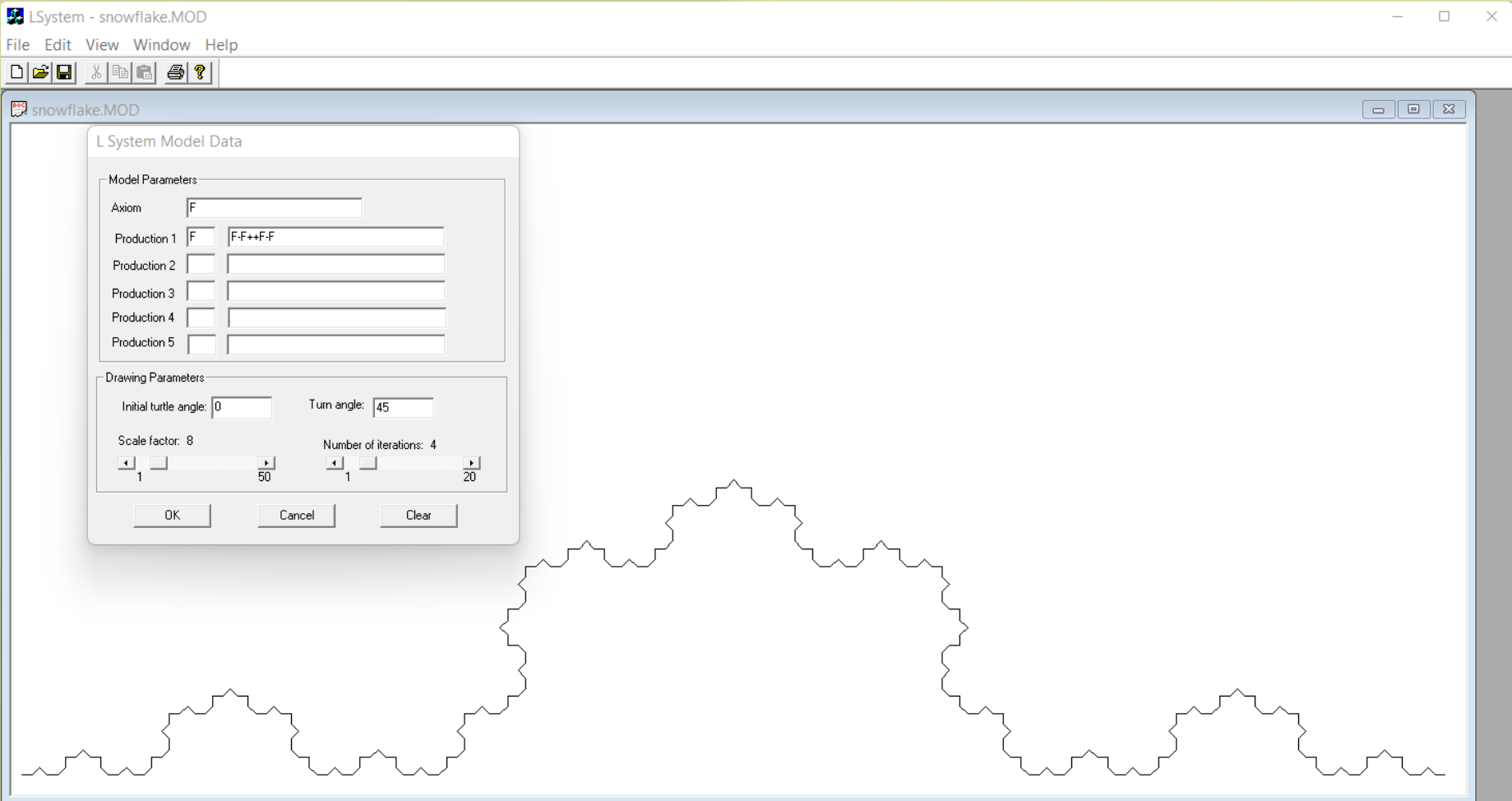
(Observe the self similarity in the strings.)

- ## The von Koch snowflakes can be generated by an L system.

L-system example

- Lindenmayer's original L-system for modelling the growth of algae.

    variables : A B

    axiom : A

    rules : $(A \rightarrow AB), (B \rightarrow A)$

which produces:

        n = 0 : A

        n = 1 : AB

        n = 2 : ABA

        n = 3 : ABAAB

        n = 4 : ABAABABA

        ……………………………

L-system example

- Cantor set

    variables : A B

    axiom : A

    rules : (A → ABA), (B → BBB)

(Let A mean "draw forward" and B mean "move forward".)

    This produces the famous Cantor's fractal set on a real straight line.