Plants and L-Systems

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Problem

- Modeling trees is hard
- Modeling forests is harder
- Need mathematical model
Lindenmayer Systems

- Formal grammars
- Prusinkiewicz et. al.
- The Algorithmic Beauty of Plants
- Very extendable
Approach

- Generate models with L-Systems
- Render models with pbrt
- Add randomization and strive for realism
Simple L-Systems

- Turtle drawing
- Fractals
- Algae

\[ f: \text{ ff-f-f+f} \]
2D L-Systems

Hexagonal Gopser curve

A Koch curve

The Sierpinski gasket

A second Koch curve
3D L-Systems

3D Hilbert curve.
Moving to plants

- Branching
- Segment thickness
- Color
- Leaves

$f: f[f+f]f[-f]$
Simple plants

Some 2D plant-like structures from bracketed L-Systems.
Higher plants: flower
Higher plants: tree
Stochastic L-Systems

- Randomness is vital
- Combinatorial explosion
- Multiple productions per symbol

\[ f(20): \ ff+f \]
\[ f(80): \ \text{f[+f]} \]
Stochastic flowers

Some stochastic flowers.
Realism is hard

- Bark texture
- Leaves’ position, shape, texture
- Branching gaps
Improved tree model
Difficulties

- Shape plugin format
- Material restrictions
- C++
Data flow

L-System

lsystem.py

Model

Textures

pbrt

Scene

Image of a tree
Future

- Parametric L-Systems
- More randomization
- Creation of new L-Systems
Demo