

A MODEL AND A SOFTWARE ARCHITECTURE FOR PLANT GROWTH SIMULATION

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I. Introduction

II. Plant model

III. Software architecture

IV. Interactive software interface

V. Conclusion and future works

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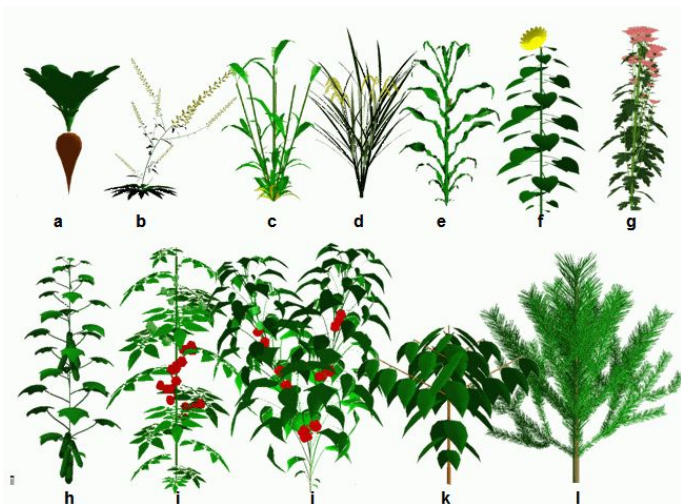
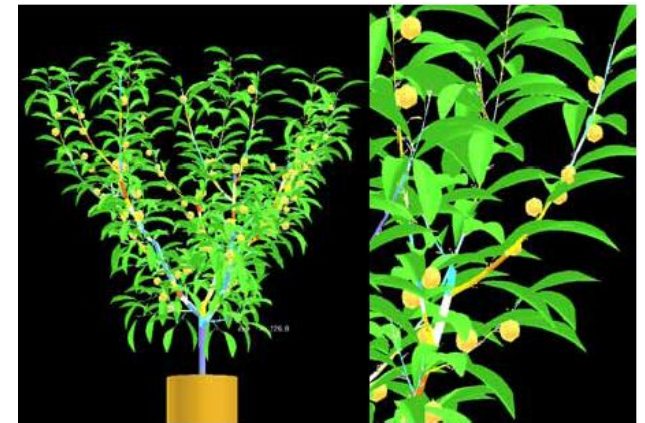
V. Conclusion and future works

Models/Simulators

- Models for Abstraction
 - Concepts
 - Equations
- Tools
 - Uml
 - Devs
- Simulators to test models with computers
- Hardware/Environment/Language

Plant Models/Simulators

- Computer image oriented
 - **OnyxTree** (Bosanac et Zanchi, 2002)
 - **XFrog** (Deussen 2003)
- Structure oriented
 - **Amap** (de Reffye, 1988)
 - **GroImp** (Kniemayer, 2004)
- Functional/structural oriented
 - **Vica** (Wernecke 2000)
 - **DigiPlante** (Cournède 2006)



Nice,
But...



Our improvement

- A plant growth model faithful to botanical knowledge (AmapSim)
- A software framework for plant simulation (Vitis)
- A flexible plant simulator

I. Introduction

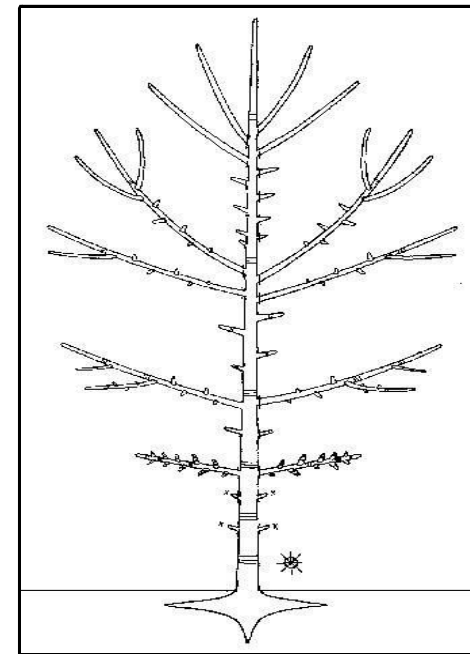
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- From plant architectural analysis
- The aim
 - Dynamic growth along time
 - Mimic axes distributions
 - Mimic shoot distributions
 - Mimic internodes distributions
- The tools
 - Using stochastic process
 - Mapping empirical geometry



Botanical assumptions

- Plant architecture is set thanks to meristems production
- Each meristem is running the same process
 - Apical growth
 - Branching
 - death
- Meristems capabilities are set at birth time and change along their life

Mathematical models

- Plant architecture is set thanks to meristems production
 - > Events scheduler
- Each meristem is running the same process
 - Apical growth -> Markov process
 - Branching -> Reliability theory
 - death
- Meristems capabilities are set at birth time and change along their life
 - > Left-right automaton

MODELS ARE FIXED

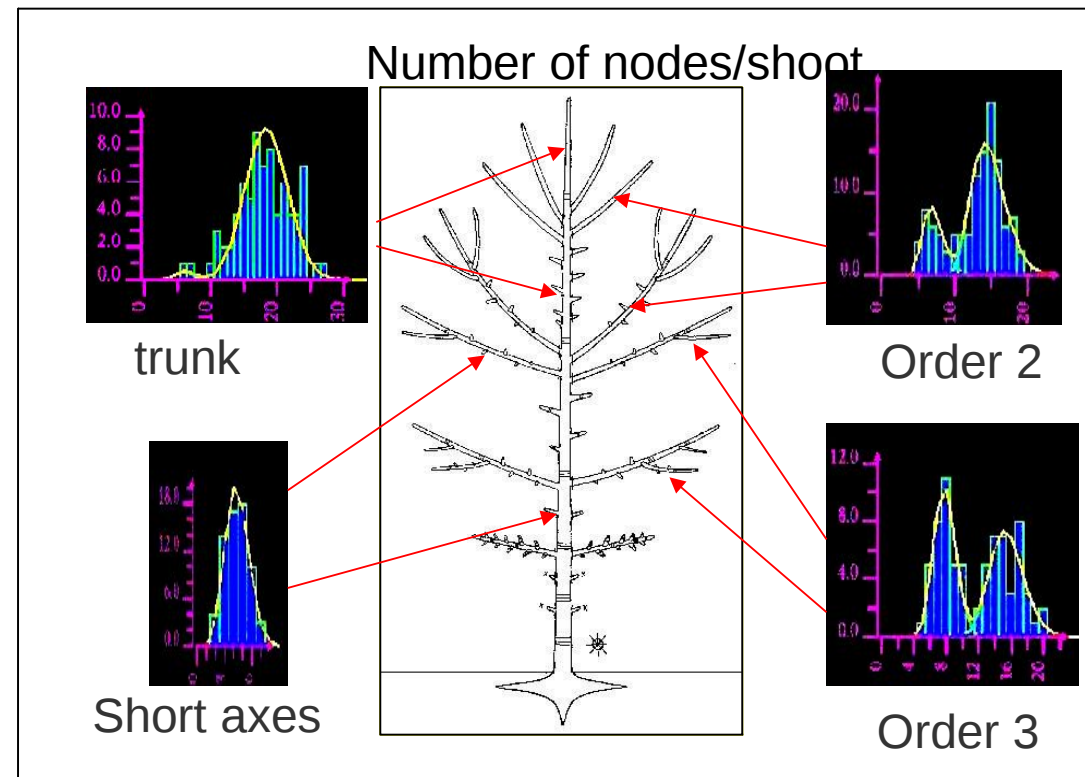
 - *Parameters values describe species*

Apical growth

- Detailed description of shoots

- two zones
- polycyclism
- delayed starting
- growth rhythm

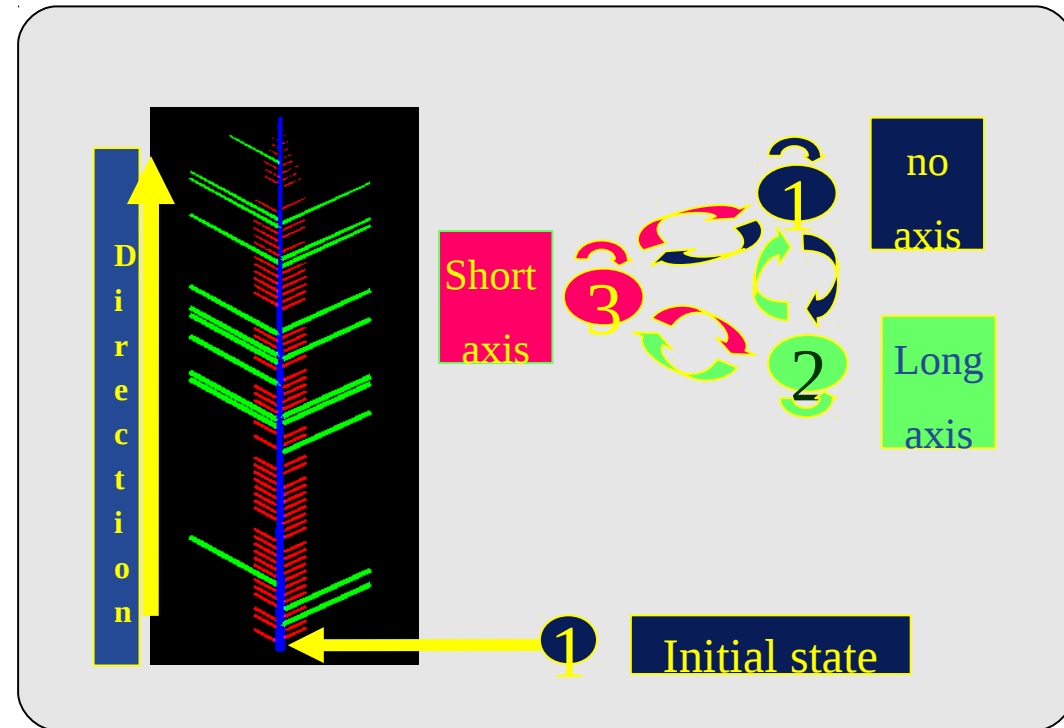
➔ **Compound binomial laws**



Phytomers distributions in the growth units of a Cherry tree (Fournier, 1989)

Branching

- Dynamic of birth
 - immediate
 - delayed
 - traumatic
- Ramification direction
- Counting unit
- ➔ Markov process
 - *Even leaves and fruits are considered as branches*



(Elguero. 1990)