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Packages : VPlants.MTG
Authors : Christophe Godin
Team : Virtual Plants
Credits : E. Costes, H. Sinoquet (Plant data)

Multiscale Tree Graph

The topology of a plant (adjacency relationship between plant components) is formally represented as a multiscale tree graph (MTG):

Encoding a multiscale graph

Plant structures can be encoded in text form that correspond to their MTG representation.
Different types of informations can be stored in the MTG structure.

Geometry of a plant

Difference between the geometric and the topological informations in a plant:

Both representations can be linked by attaching a geometric model to each component (or vertex) of a MTG:
PlantFrame

The PlantFrame function of the VPlant.MTG module makes it possible to build a sketch (plantframe) of the plant geometry from any MTG.

This plantframe is made of a geometric skeleton of the plant branching system plus additional geometric information for each plant segment such as bottom and top diameter.

To compute a geometry attached to a MTG, the user must select a representation scale.

Then, the PlantFrame function computes a default geometry using default algorithm and as much as possible of the information stored in the MTG. This function can be easily tuned by redefining its default algorithms using user-defined functions.

Changing the default diameter:

Tuning the insertion angles of branches:

Plotting PlantFrame

Various informations can be projected onto the reconstructed plant geometry to investigate the plant organization. Here the axes of the plantframe f1 are colored according to their branching order:

Case of 3D digitized plants

Various types of information can be measured with the plant structure, including the exact position, orientation and form of each component. Here, a 3D digitizing magnetic method is illustrated on an apple tree architecture:

Virtual leaves can be added to the structure in a post processing phase.