Some leaf surface shapes
Leaf surface fitting

- Input: data points
- Projection of data points onto reference plane
- Triangulation
- Piecewise linear fit / piecewise cubic fit based on interpolation
- Output: leaf surface model
Leaf surface models so far

Interior: 5
Boundary: 18
Applications

• Water droplet simulation
• Accurate shadows
• Insect movement
• Photo-realistic images
The problem

• Boundary is piecewise linear curve.
• How can it be improved using the same surface fitting techniques?
• Extension/reduction to make surface fit a parametric boundary curve?
The solution
Extension/reduction in 2D

reduce

extend

split in two
Extension/reduction in 3D

reduce

curve lies on surface
reduction of domain

extend

- extrapolation
- interpolation
- subdivision
Extension: extrapolation

- Evaluation of surface function outside triangular domain = extension of domain
- Problem: can show bad behaviour depending on triangle orientation and chosen boundary curve
- “Extrapolation is usually considered as a bad way to approximate functions…” (Dyn, Levin, Rippa, 1992)
Extension: interpolation

- 3D curve given
- Piecewise (pcw) linear interpolation between edge 3 and curve segment c
- Less smooth transition because of linear fit
- Use pcw cubic interpolation instead?
Extension: subdivision

• A triangle is added in region between edge 3 and curve segment c, this method can be repeated for remaining regions
• Third corner of new triangle found either on 3D curve or by extrapolation of surface function
• Erratic behaviour
• Similar to approach by Levin (1999)
The model

interpolation  extrapolation  subdivision
The model

interpolation
extrapolation
subdivision
More models

Interior: 45
Boundary: 79
More models

Interior: 46
Boundary: 38
More models

Interior: 60
Boundary: 77
Outlook

- Different curves possible – depending on boundary type
- Capture variation
- Example: serrated edge based on sine functions