Session 4 *(In preparation for Class 4, students are asked to view Lecture 4.)*

Topics for Class 4

Efficient origami design: Uniaxial, TreeMaker and Origamizer in practice, box-pleating tree method, tree method triangulation, universal molecule, gift wrapping, checkerboard gadgets, Origamizer software vs. mathematics, vertex/edge tucking molecules, Voronoi diagrams.

Detailed Description of Class 4

This class covers several additional details about Lecture 4 (efficient origami design):

- How is complex origami design we've seen uniaxial?
- How are TreeMaker and Origamizer used in practice?
- Box-pleating version of the tree method from Origami Design Secrets (2nd edition)
- Triangulation algorithm for the tree method
- Universal molecule example
- Gift-wrapping problems are still open
- How to fold the more efficient checkerboard
- How the Origamizer software works
- How the guaranteed-correct Origamizer algorithm is more complicated

Topics for Lecture 4

Efficient origami design: Tree method, TreeMaker, uniaxial base, active path, rabbit-ear molecule, universal molecule, Margulis Napkin Problem; cube folding, checkerboard folding; Origamizer, watertight, tuck proxy.

Detailed Description of Lecture 4

This lecture is all about efficient origami design. We saw in Lecture 2 how to fold anything impractically. Now we'll see how to fold many shapes practically.

First up is the tree method, whose software implementation TreeMaker I demoed at the end of Lecture 3. I'll describe how it lets us fold an optimum stick-figure (tree) origami base, although computing that optimum is actually NP-complete (as we'll see in Lecture 5). This algorithm is used throughout modern complex origami design; I'll show some examples by Robert Lang and our own Jason Ku.

Second we'll look at a simple, fully understood case: the smallest square to fold a cube.

Third we'll look at a classic problem that we made progress on recently: folding an $n \times n$ checkerboard from the smallest bicolor square.

Finally we'll look at the latest and most general method, Origamizer, for folding any polyhedron reasonably efficiently. Here we don't have a nice theoretical guarantee on optimality, but the method works well in practice, provably always works, and has other nice features such as watertightness.

6.849 Geometric Folding Algorithms: Linkages, Origami, Polyhedra
Fall 2012