Session 16 *(In preparation for Class 16, students are asked to view Lecture 16.)*

Topics for Class 16

Polyhedron unfolding: Topologically convex vertex-ununfoldable polyhedron; unfolding orthogonal polyhedra with quadratic refinement.

Detailed Description of Class 16

This class covers two new results about unfolding, one negative and one positive:

- There is a topologically convex polyhedron with no vertex unfolding. [Abel & Demaine 2011]
- Orthogonal polyhedra can be unfolded with only quadratic (instead of exponential) refinement. [Damian, Demaine, Flatland 2012]

We'll also briefly discuss:

- Why vertex unfoldings are so far "linear"
- Why vertex unfoldings revisit vertices
- Whether orthogonal unfoldings are practical
- Whether other lattice polyhedra can be unfolded
- Whether Cauchy's Rigidity Theorem is obvious

Topics for Lecture 16

Polyhedron unfolding: Vertex unfolding, facet paths, generally unfolding orthogonal polyhedra, grid unfolding, refinement, Manhattan towers, orthostacks, orthotubes, orthotrees.
Polyhedron folding: Cauchy's Rigidity Theorem, Alexandrov's uniqueness of folding.

Detailed Description of Lecture 16

This lecture continues the theme of unfolding polyhedra, and kicks off our coverage of folding polygons into polyhedra.

On the unfolding side, we'll cover "vertex unfolding", which is a variation on edge unfolding kind of like hinged dissections. We'll prove that this type of unfolding exists, even for nonconvex polyhedra, provided every face is a triangle. Then we'll cover recent breakthroughs in general unfolding, for orthogonal polyhedra.

On the folding side, we'll prove Cauchy's Rigidity Theorem: convex polyhedra have exactly one convex realization (viewing faces as rigid and edges as hinges). Then we'll show how to extend this to Alexandrov's Uniqueness Theorem: if you glue up the boundary of a polygon, there's at most one convex polyhedron you can make. (Next lecture we'll see how to actually get one.)