

6.849

Class 19

Nov. 15, 2012



o Fractal unfolding of cube & regular tetrahedron:

[Shirakawa, Horiyama, Uehara - EuroCG 2011]

- still a conjecture **OPEN**
- algorithm to generate common unfoldings of cube & tetrahedron...
 - but unfolding not always connected
- best so far: tetra within $2.9 \cdot 10^{-1796}$ of regular
using $\approx 10^{180}$ edges!

o Common unfolding of boxes:

[Abel, Demaine, Demaine, Matsui, Rote, Uehara - CCCG 2011]

- $4 \times 4 \times 8$ & $\sqrt{10} \times 2\sqrt{10} \times 2\sqrt{10}$ 
- found by integer programming
- $1 \times 1 \times 5$ & $1 \times 2 \times 3$ & $0 \times 1 \times 11$ 
- 2,263 common grid unfoldings - just one folds to
- double resolution for grid unfolding of $0 \times 1 \times 11$
- $L \times 1$ rectangle folds into $\geq 2 + 4L$ flat boxes

[Shirakawa & Uehara - CCCG 2012]

- $7 \times 8 \times 14$ & $2 \times 4 \times 43$ & $2 \times 13 \times 16$
- $7 \times 8 \times 56$ & $7 \times 14 \times 38$ & $2 \times 13 \times 58$
- infinite sequence of 3-box examples: $\forall k \geq 0$
 $(4k+7) \times 2(k+4) \times 8(4k+7)$, $(4k+7) \times 2(4k+7) \times 2(7k+19)$, $2(k+1) \times (4k+3) \times 2(16k+29)$
- **OPEN**: common unfolding of 4 boxes?

- Smooth unfolding is not a limit
(area shouldn't jump at the end)
 - many discretizations \rightarrow different gaps
 - no one limit \rightarrow many limit points
 - smooth unfolding \approx union of limit points
hence increase of area

- Theo Jansen's Strandbeests

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

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