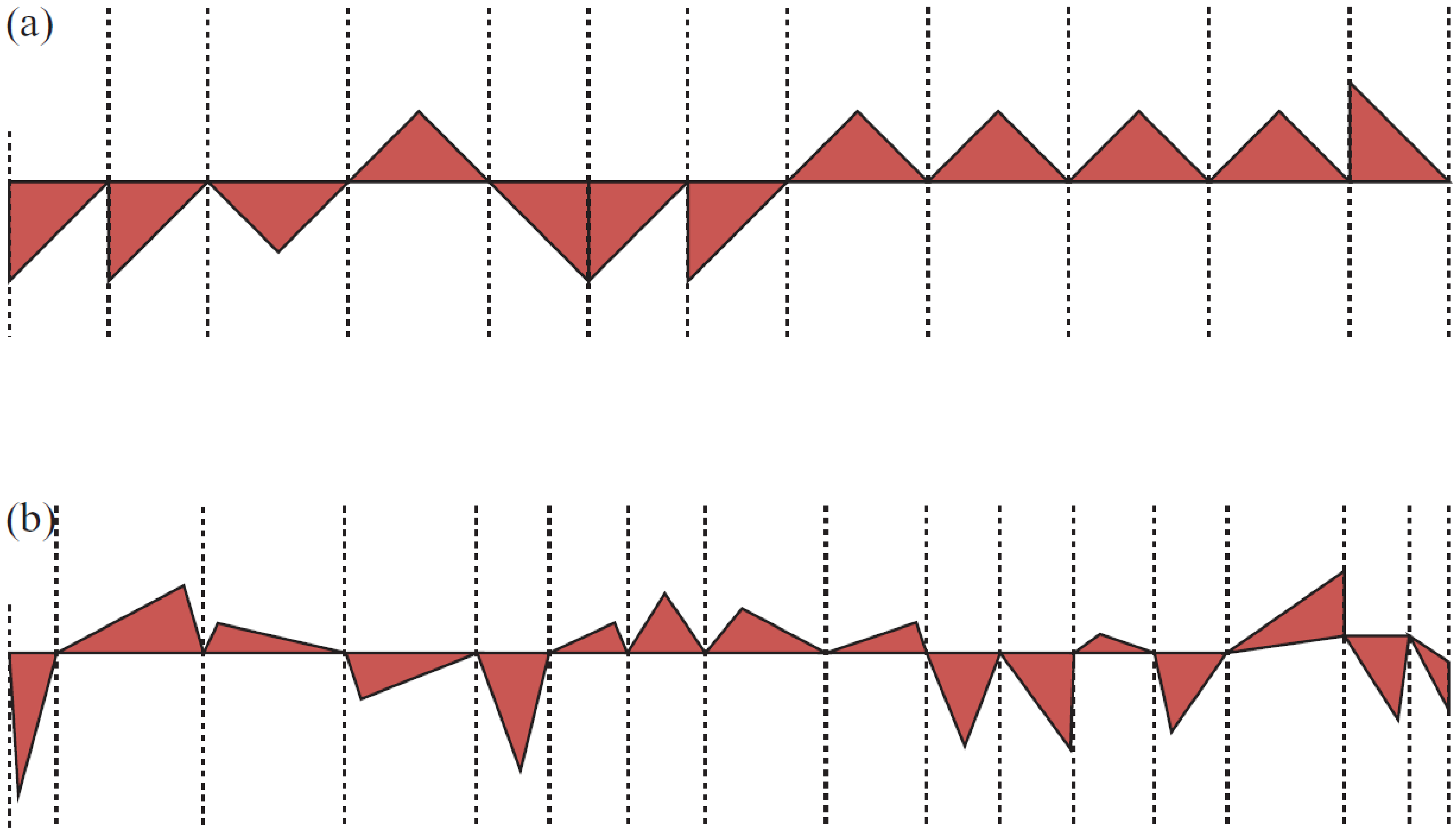
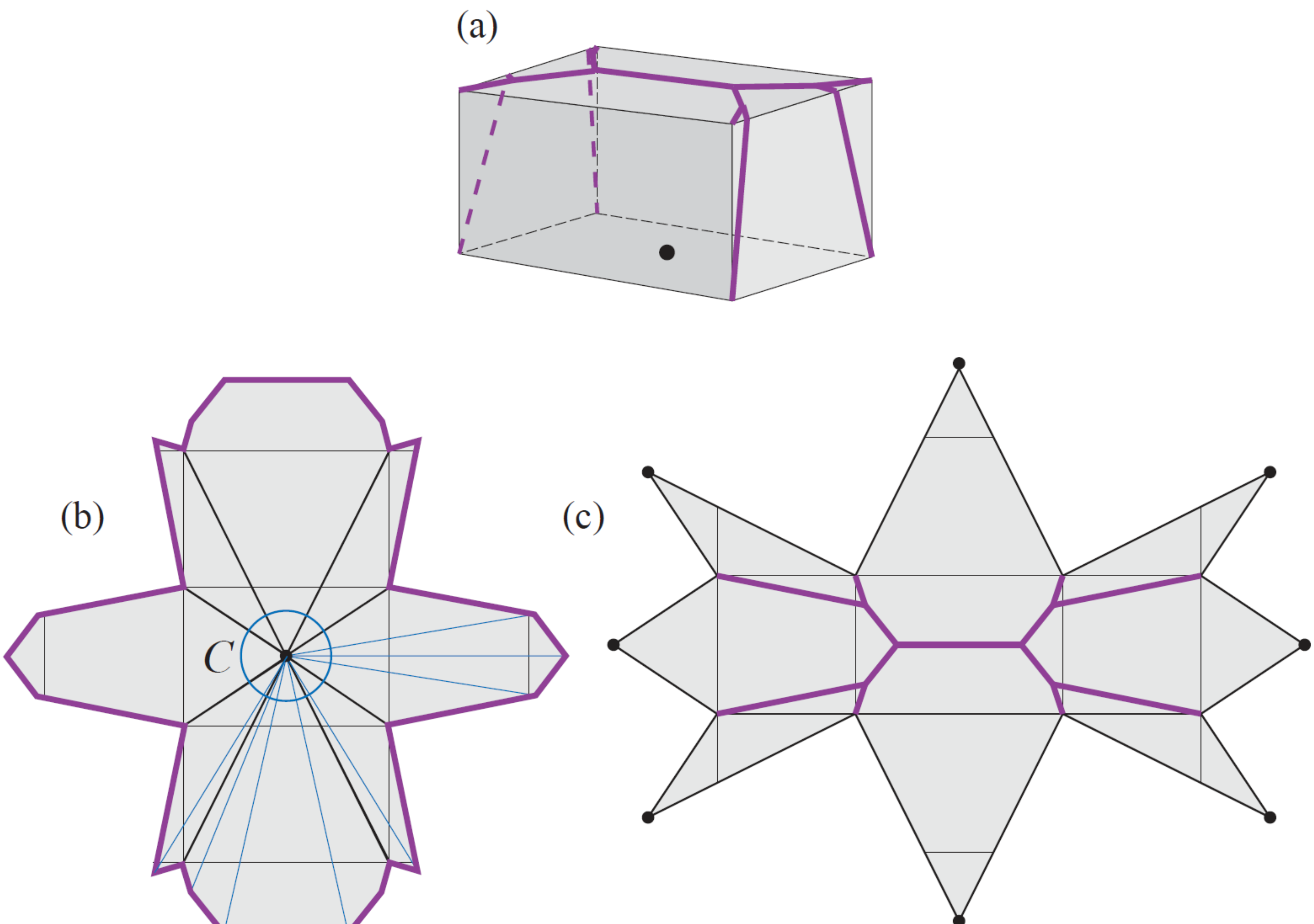
Does vertex unfolding have to be connected in a line format? Or is that just the method demonstrated? Are there any methods which unfold into a tree instead of a line?

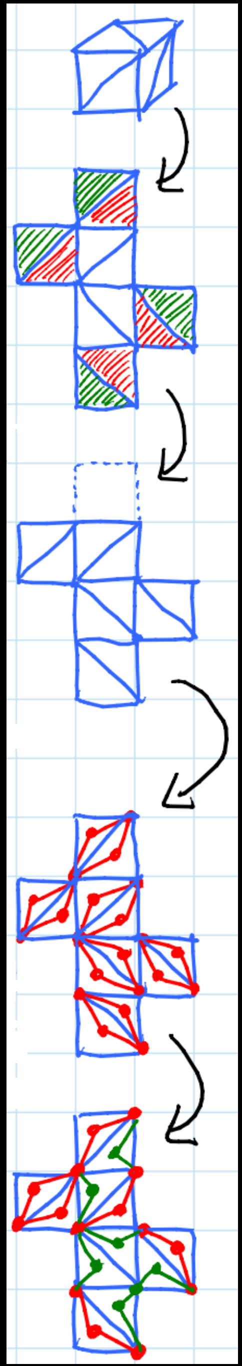


[Demaine, Eppstein, Erickson, Hart, O'Rourke 2001/2003]

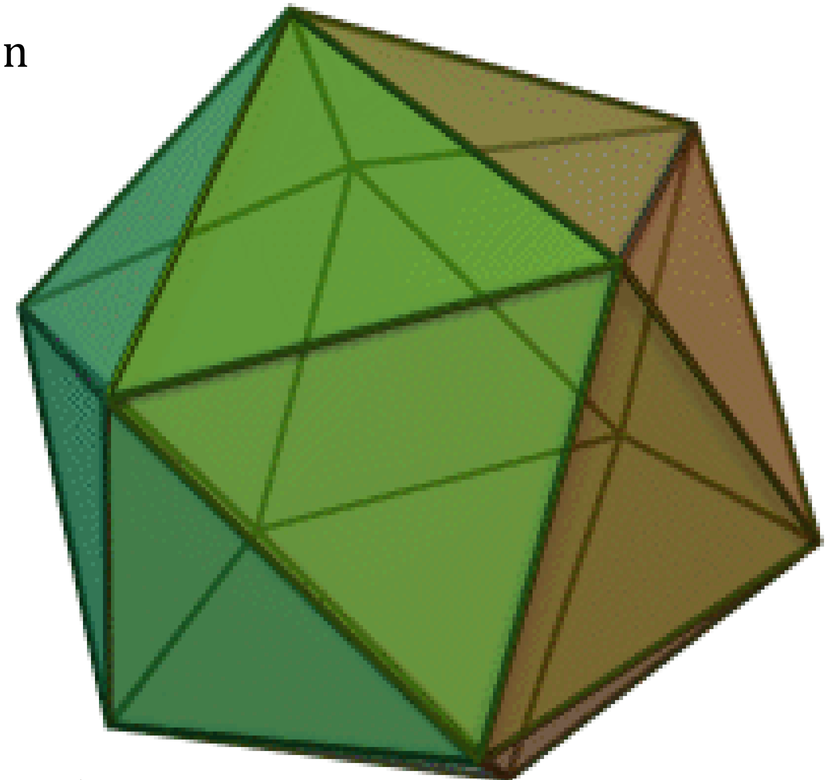


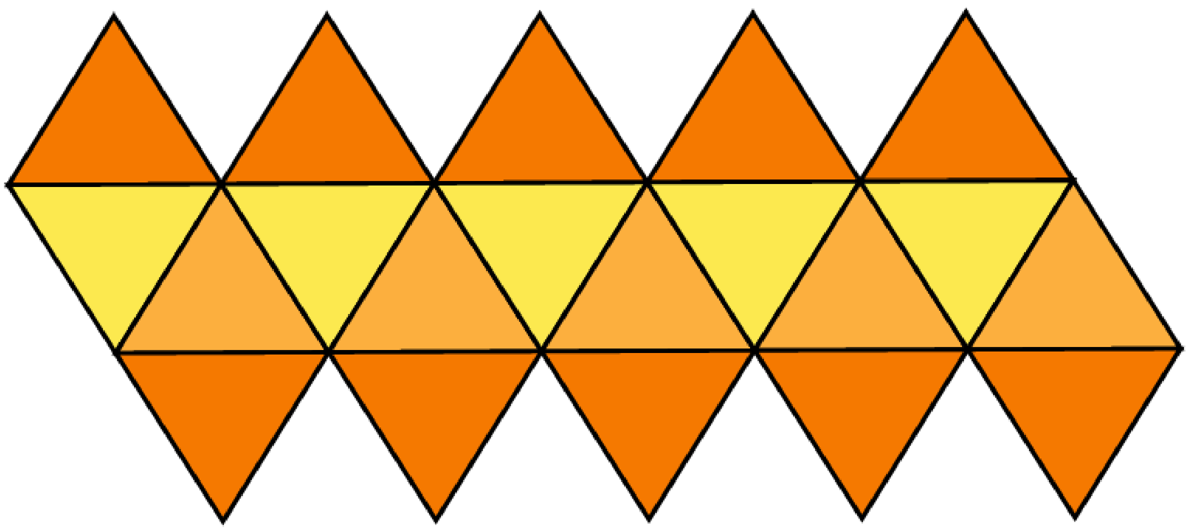
[Demaine & Lubiw 2011]

It looks like the final Euler path visits the same vertex multiple times. Are you assuming that you can cut the vertex in two and keep it as a connection for multiple pairs of triangles? Have you considered the case where you can't split vertices like that?

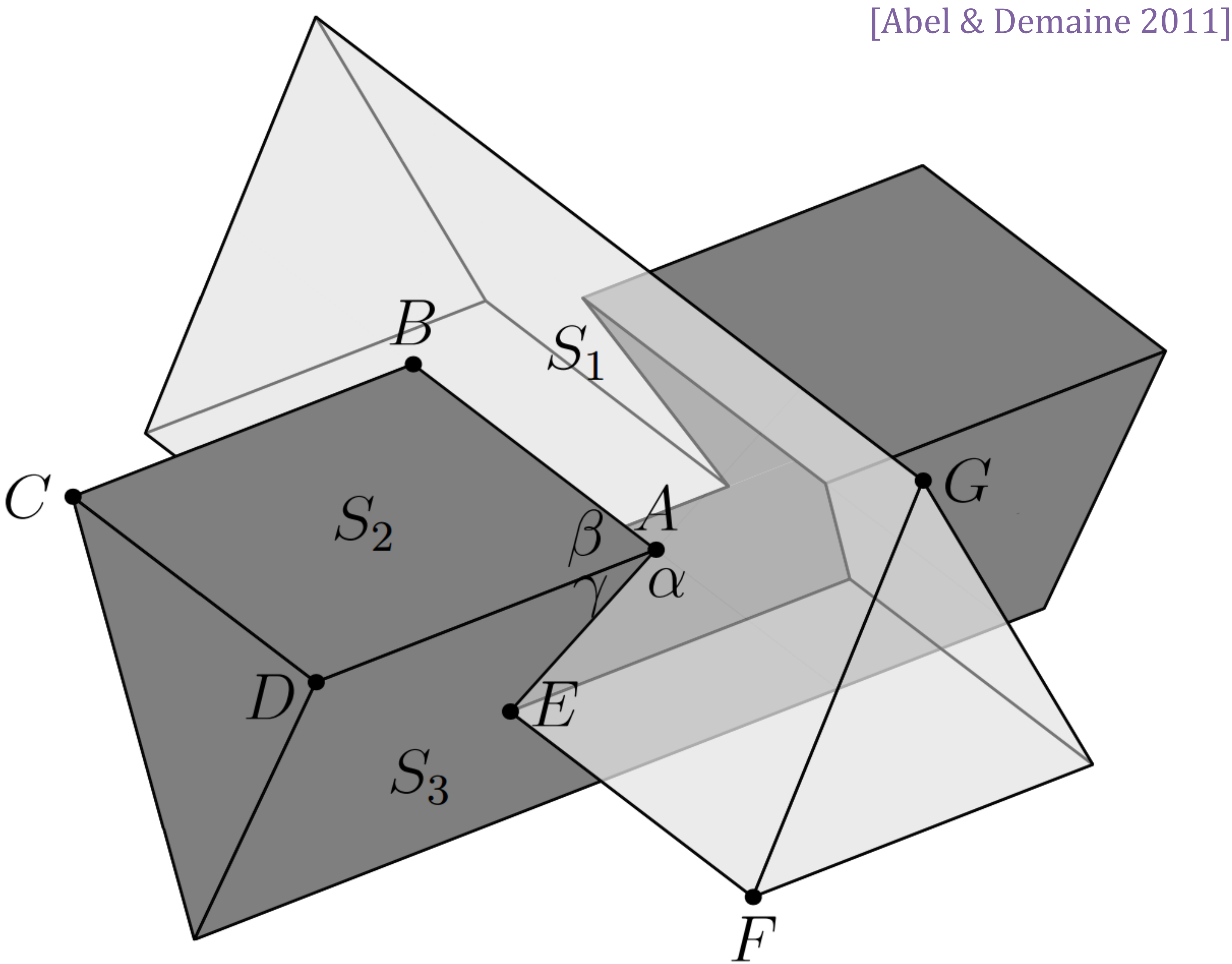


http://en.wikipedia.org/wiki/Icosahedron

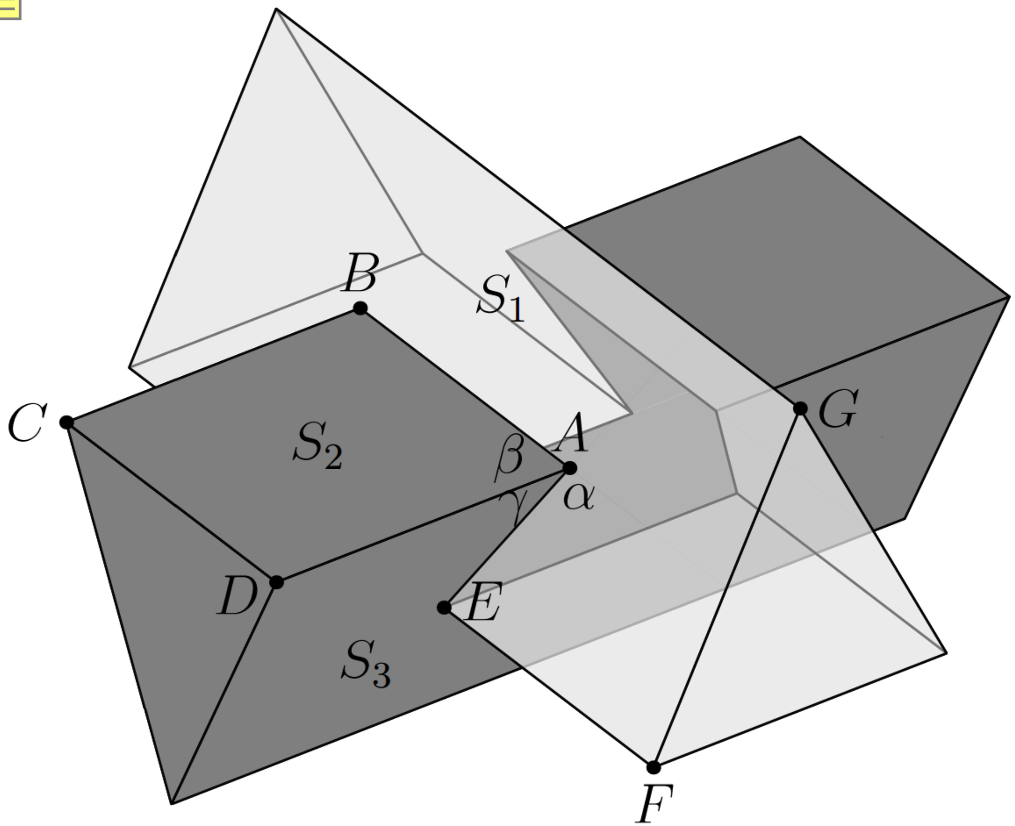


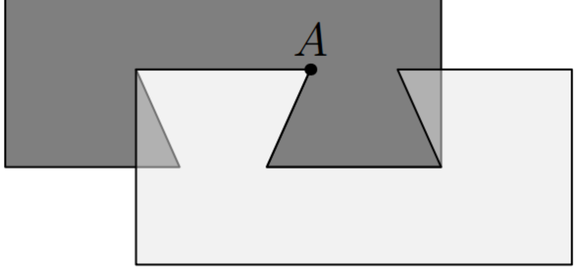


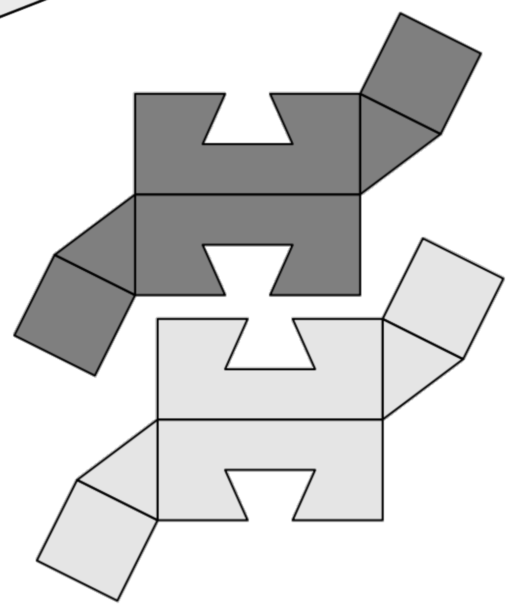
Any progress on vertex unfolding?

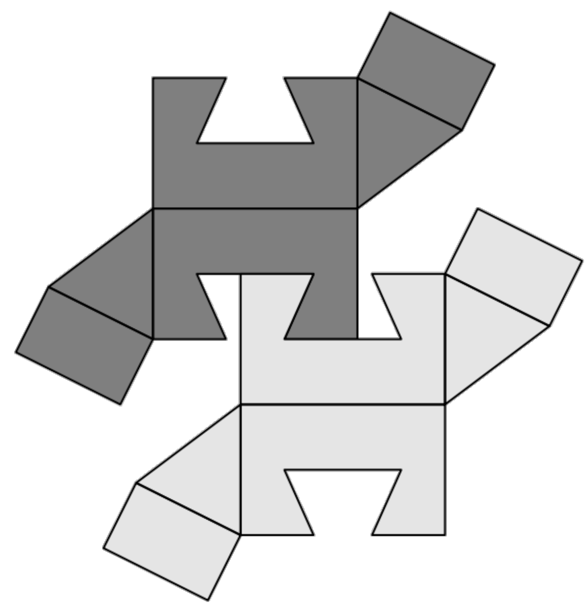

[Abel & Demaine 2011]
B
S_1
C
S_2
A
β
α
γ
G
D
E
S_3
F

[Abel & Demaine 2011]

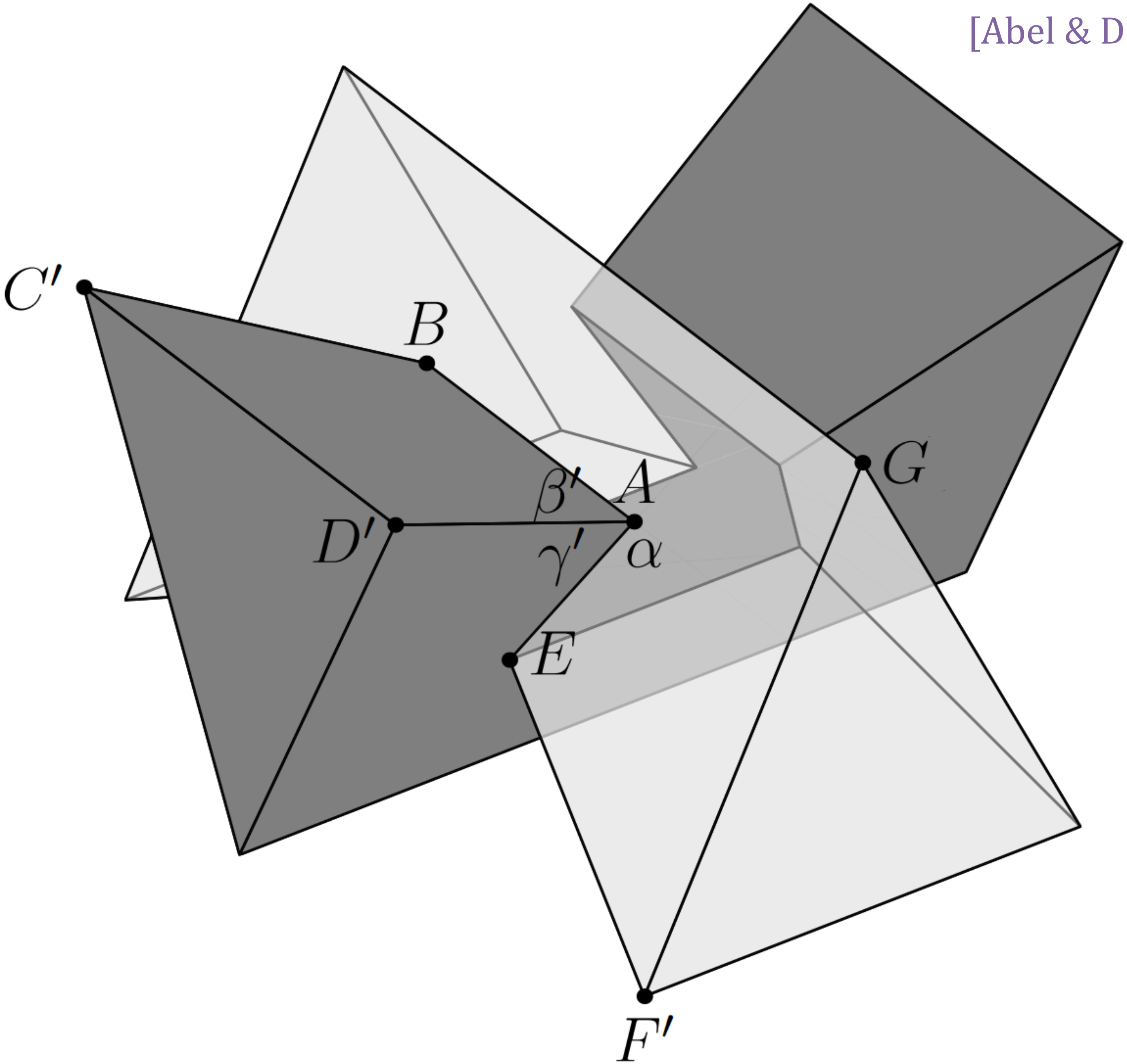








[Abel & Demaine 2011]



Has anything more been proven in regards to the general unfolding for nonconvex polyhedra?

Unfolding Orthogonal Polyhedra with Quadratic Refinement: The Delta-Unfolding Algorithm

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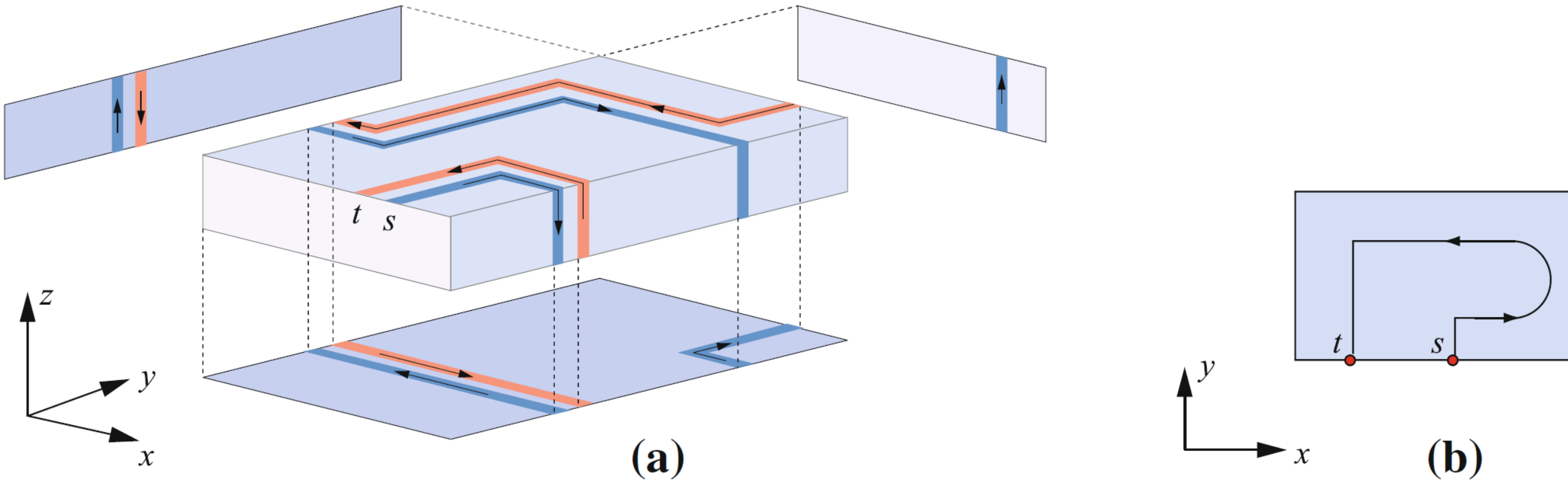
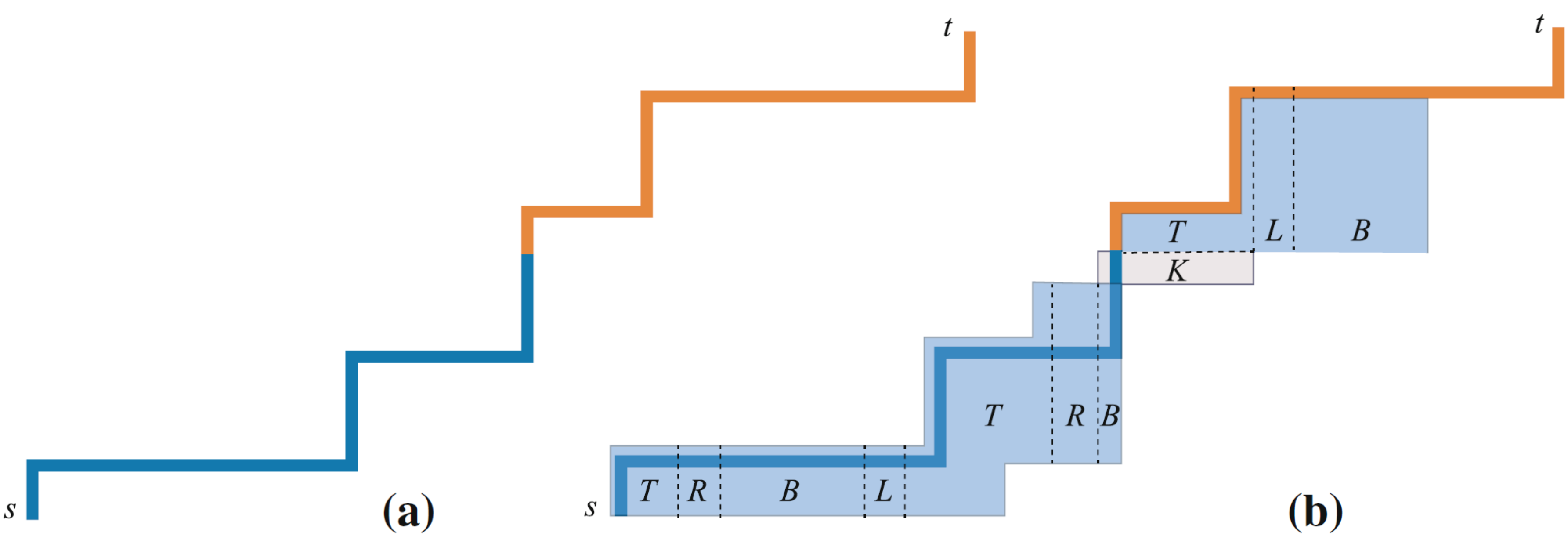
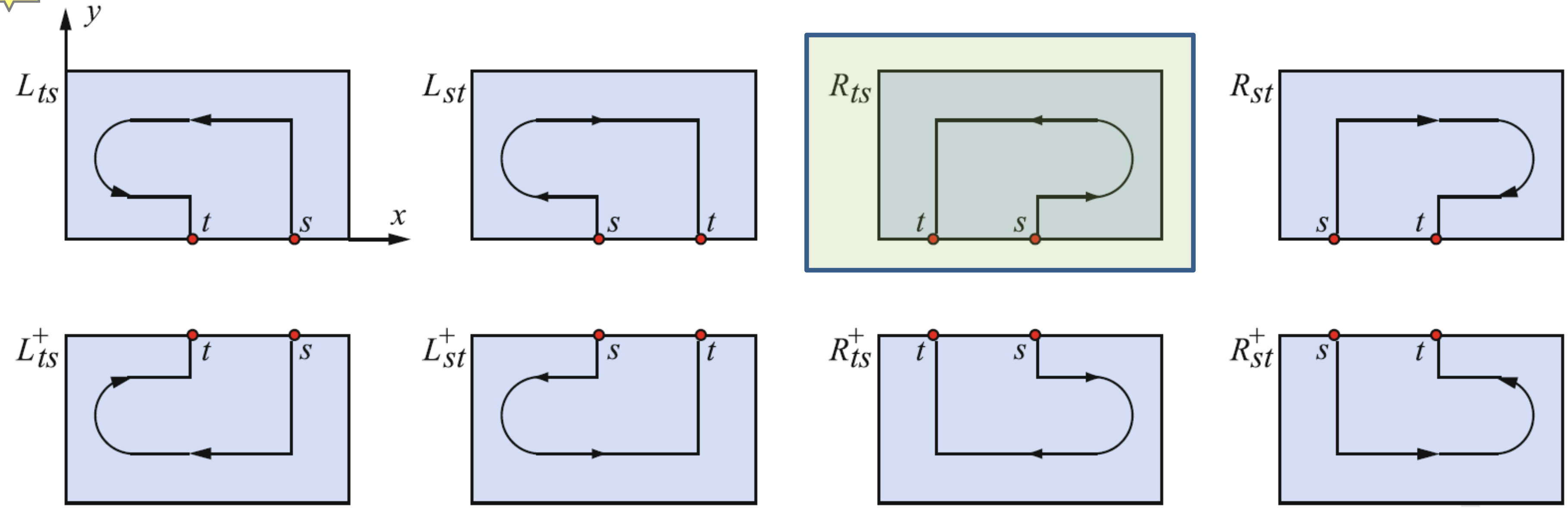
Abstract. We show that every orthogonal polyhedron homeomorphic to a sphere can be unfolded without overlap while using only polynomially many (orthogonal) cuts. By contrast, the best previous such result used exponentially many cuts. More precisely, given an orthogonal polyhedron with n vertices, the algorithm cuts the polyhedron only where it is met by the grid of coordinate planes passing through the vertices, together with $\Theta(n^2)$ additional coordinate planes between every two such grid planes.

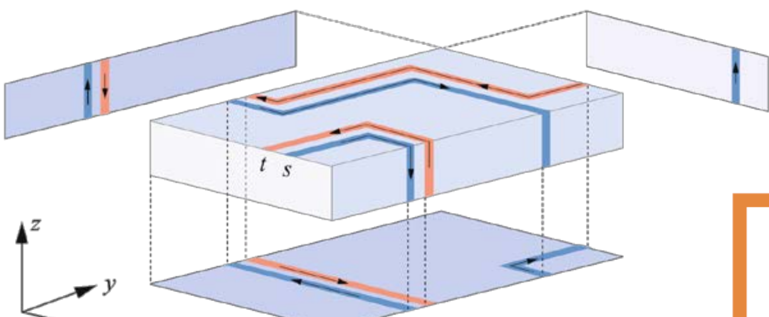
Key words. general unfolding, grid unfolding, grid refinement, orthogonal polyhedra, genus-zero

[Damian, Flatland, O'Rourke 2012]



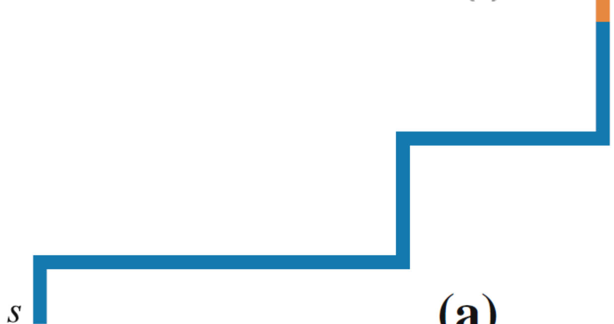


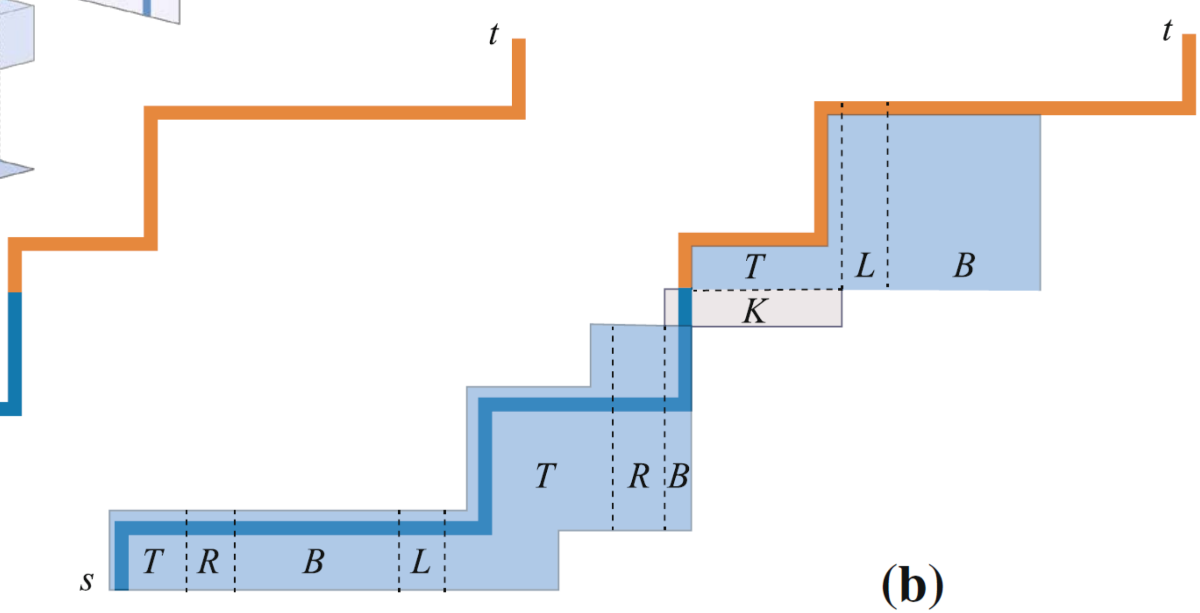




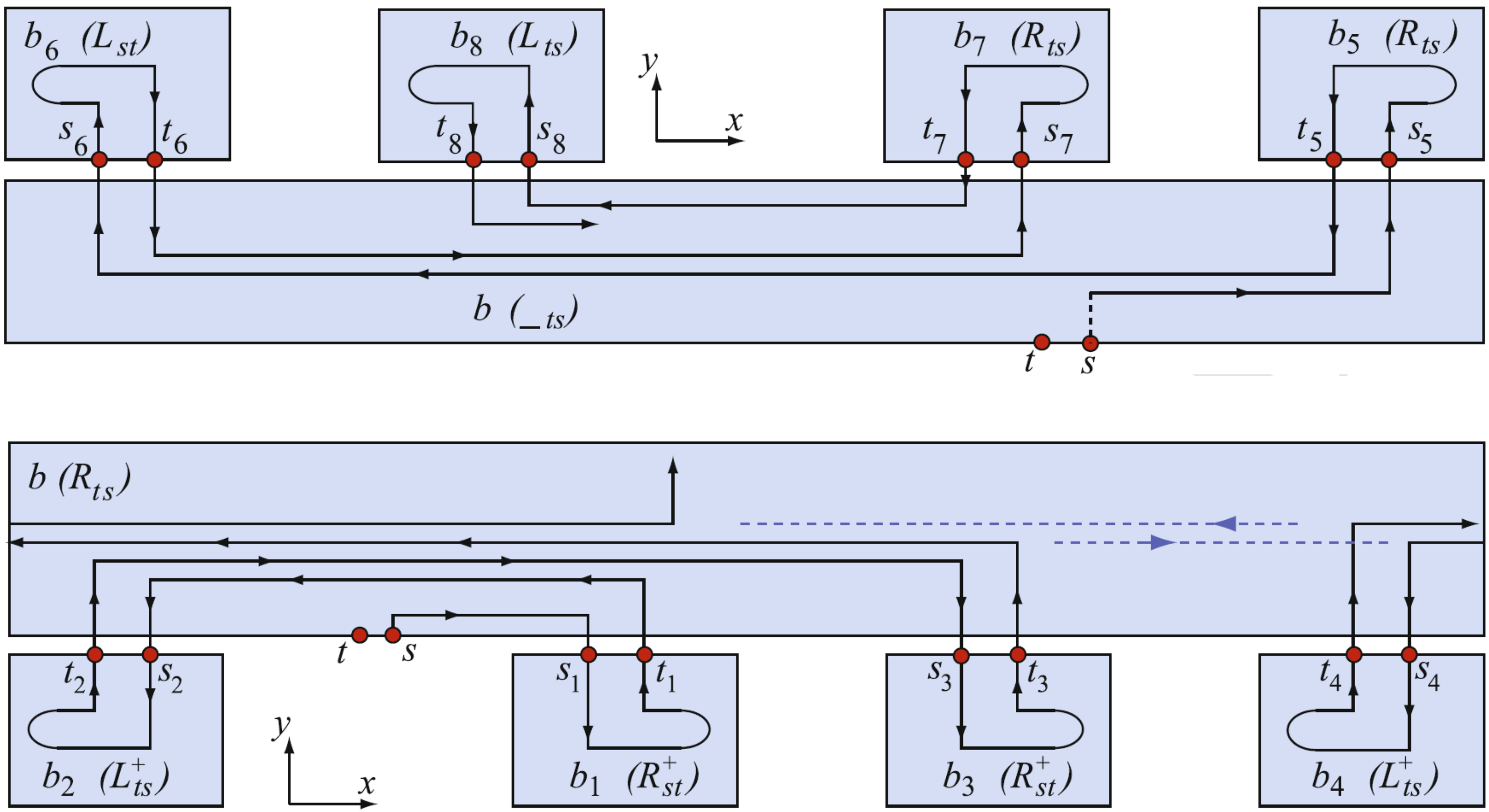
(a)

[Damian, Flatland, O’Rourke 2012]

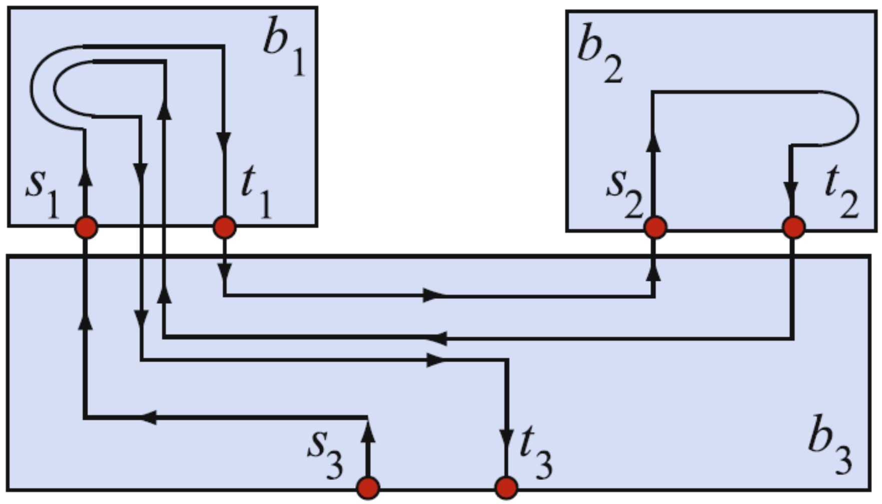


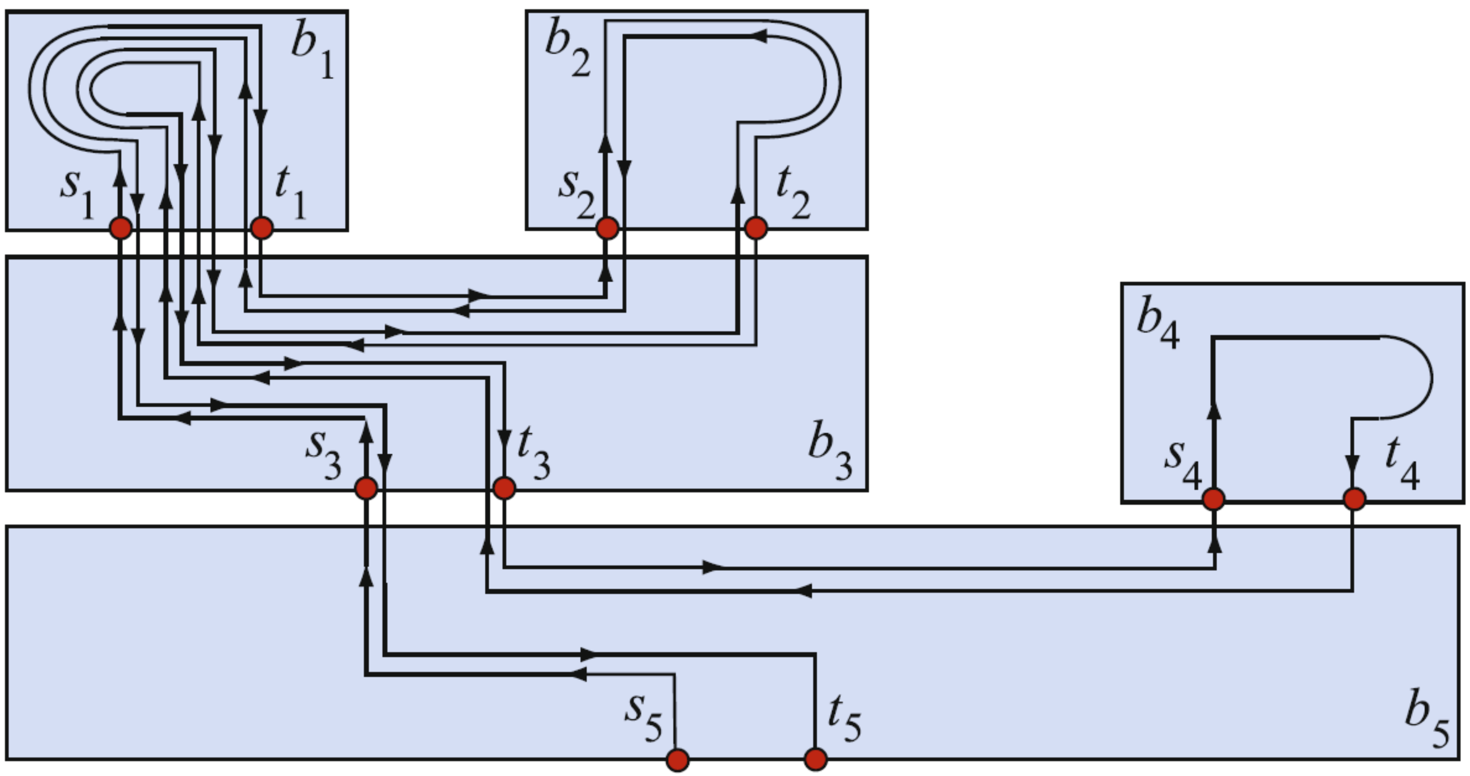


[Damian, Flatland, O'Rourke 2012]

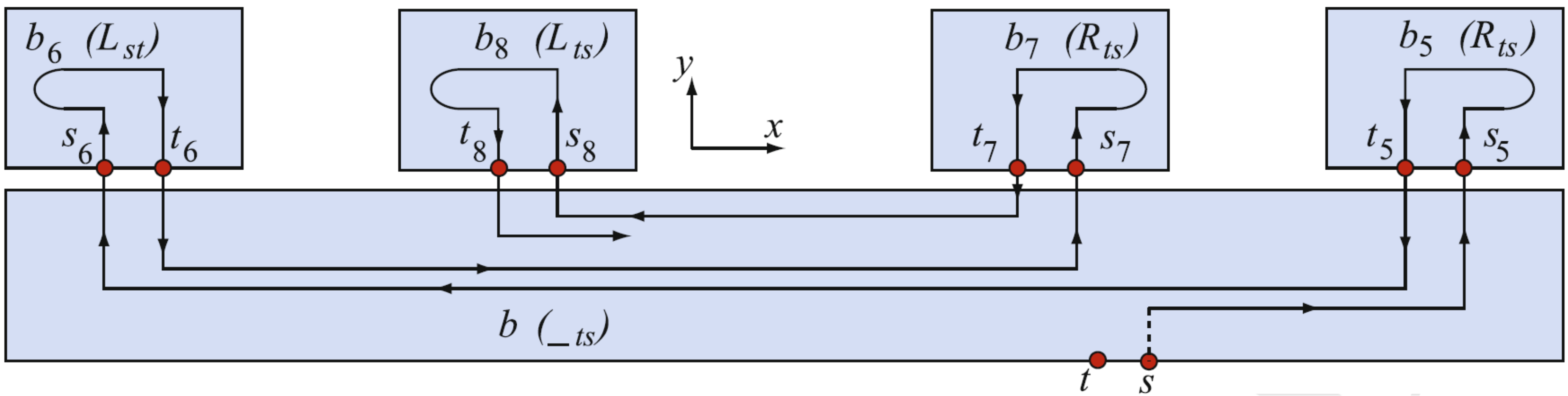


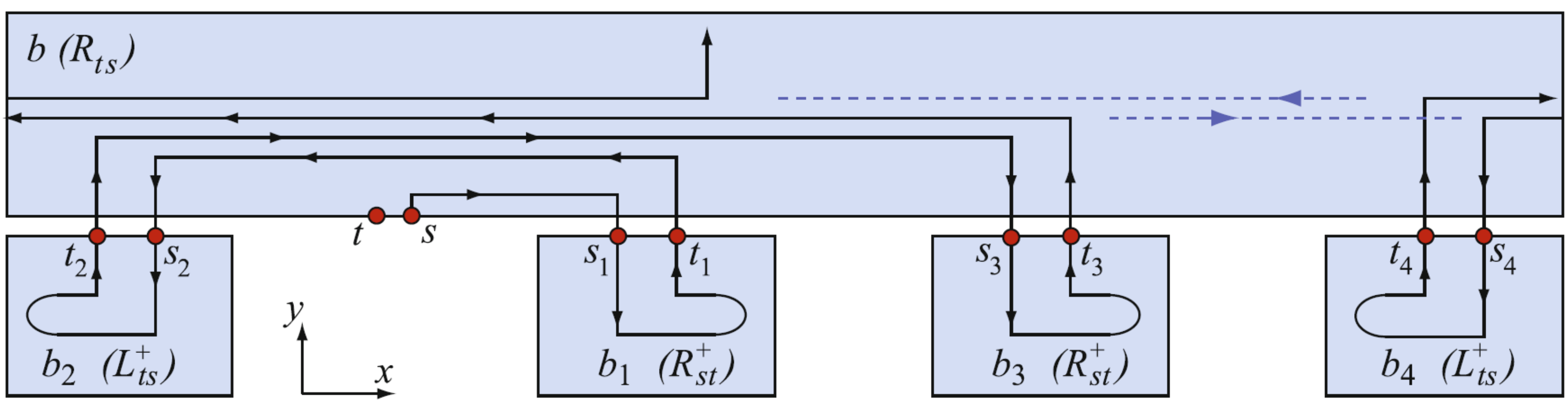
[Damian, Demaine, Flatland 2012]



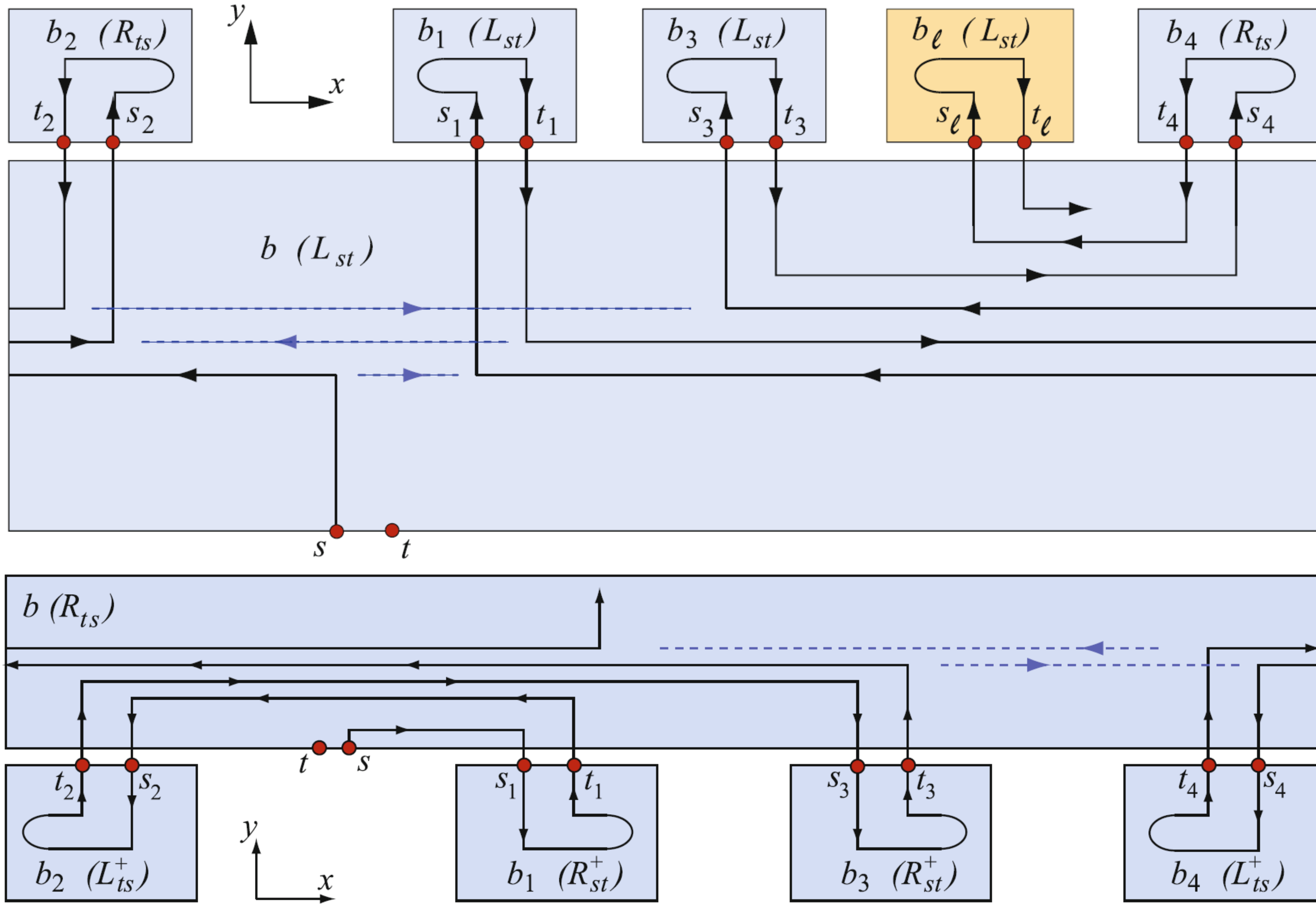


[Damian, Demaine, Flatland 2012]

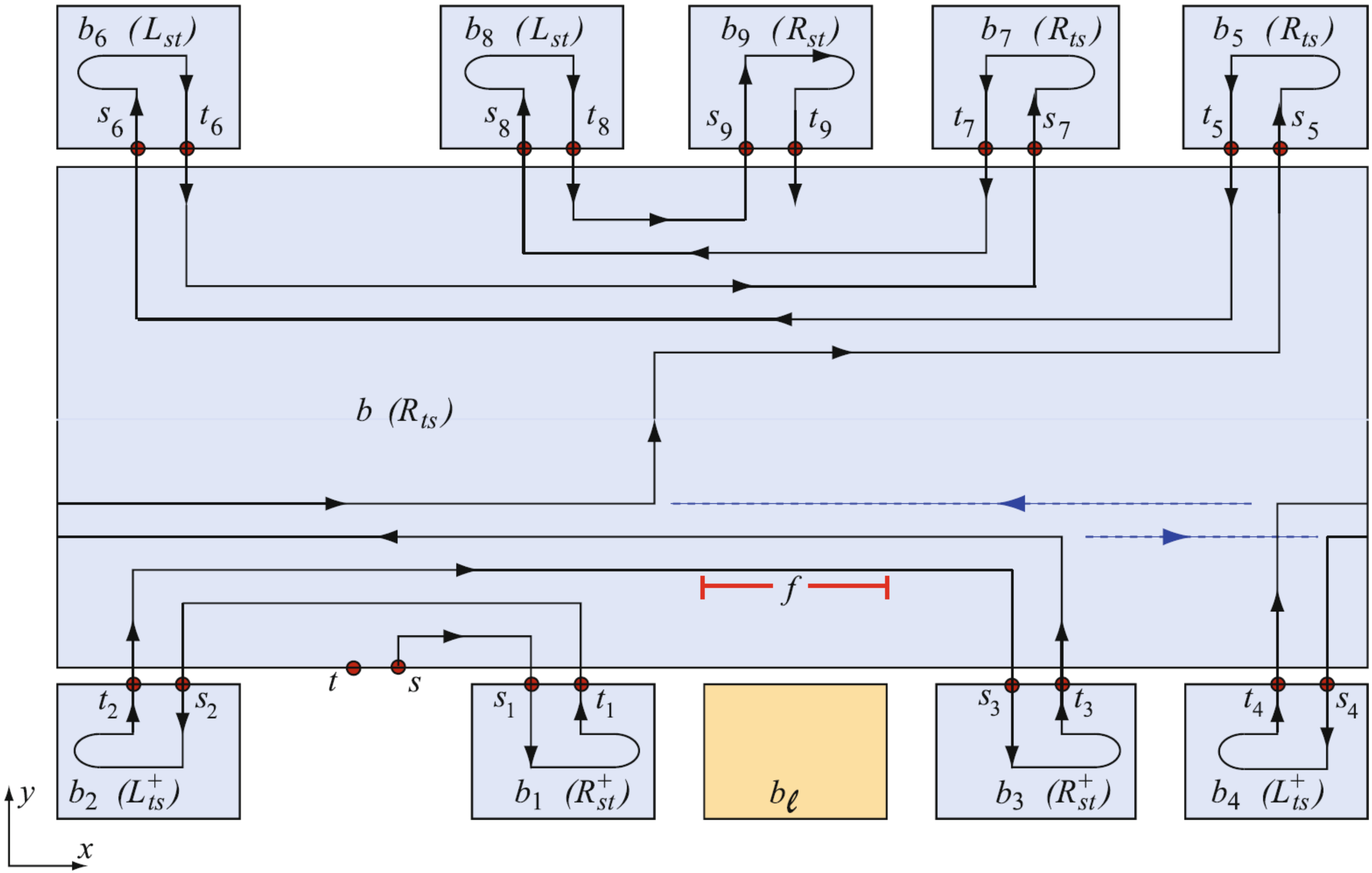




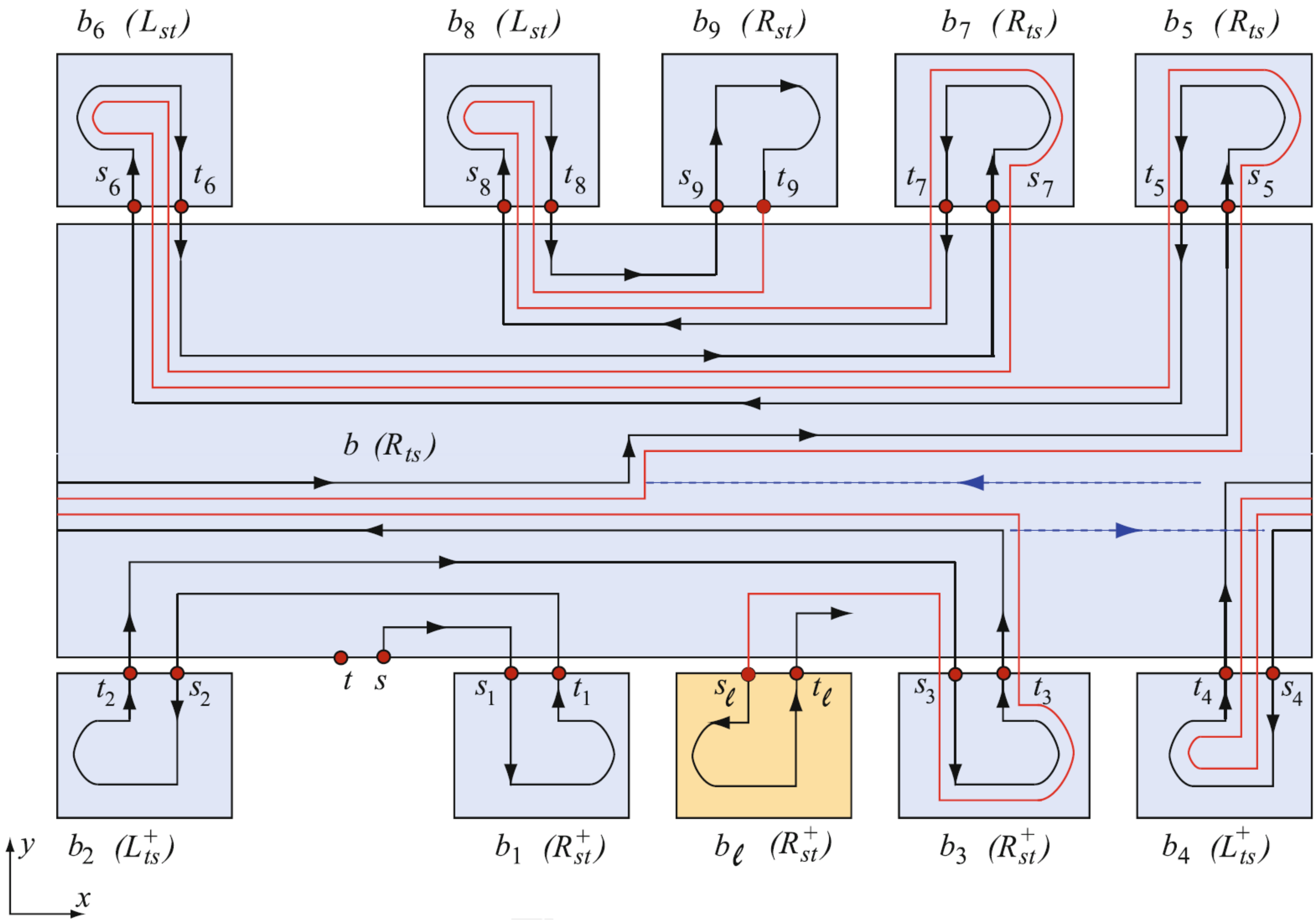
[Damian, Demaine, Flatland 2012]



[Damian, Demaine, Flatland 2012]

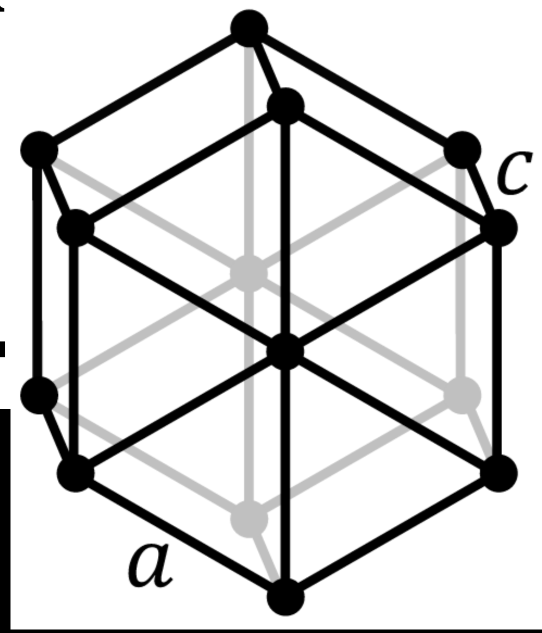


[Damian, Demaine, Flatland 2012]



Has anyone tried to build any of these unfoldings? They seem mathematically possible, but terrible to make in real life. Has anyone tried?

As orthogonal polyhedra are based on a cubic lattice (or technically orthorhombic?), are there any unfolding results about polyhedra based on other crystallographic structures? I'm thinking about hexagonal lattices…



Cauchy's rigidity theorem seems intuitively obvious. Why is my intuition wrong? Why do we need the long proof?

A symmetric flexible Connelly sphere with only nine vertices

by Klaus Steffen (I.H.E.S.)

1.) Make 14 rigid triangles and attach them to each other in a flexible fashion as indicated in fig. 1,2 (two copies!); a good choice of parameters is e.g. $a := 6$, $b := 5$, $c := 2.5$, $d := 5.5$, $e := 8.5$.

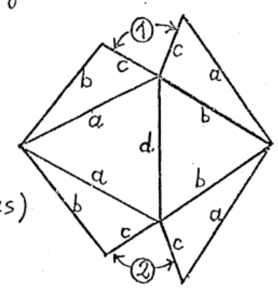
2.) Connect (in a flexible way!) the two edges marked ① in fig. 1 by rotating the corresponding triangles upward and the two edges marked ② by rotating the corresponding triangles downward (in either copy!).

3.) Attach the two aggregates of 6 triangles to each other as indicated by ③, ④ in fig. 3.

4.) Connect the two remaining single triangles (fig. 2) along edge e thereby making a "roof" which is attached to the configuration of 12 triangles from step 3.) as indicated by ⑤, ⑥, ⑦, ⑧ in fig. 3.

5.) If you did not mess up everything the resulting sphere looks like fig. 4 and flexes by about 30° as indicated by the arrows. (It is a good idea to cut a "window" in the "roof" to make the inside visible.)

fig. 1



(2 copies)

$a = u$
$b = v$
$c = \cancel{2.5}\ w$
$d = \cancel{8}\ x$
$e = y$

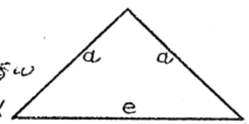


fig 2 (2 copies)

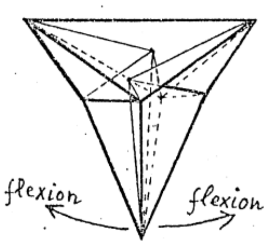


fig. 4

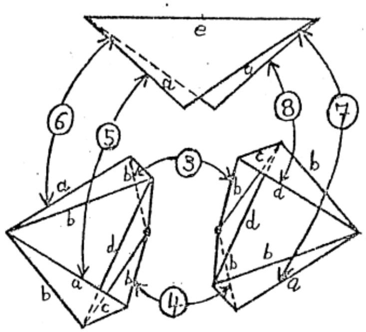
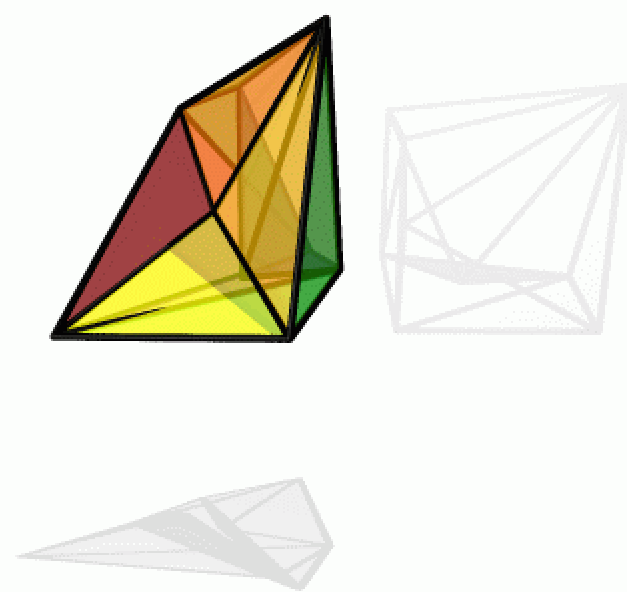


fig. 3



[Steffen 1977]

Mens et Manus 2011

Brian Chan   Ken Stone

http://hobbyshop.mit.edu

photo by Tom Gearty

glass etching by
Peter Houk