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?

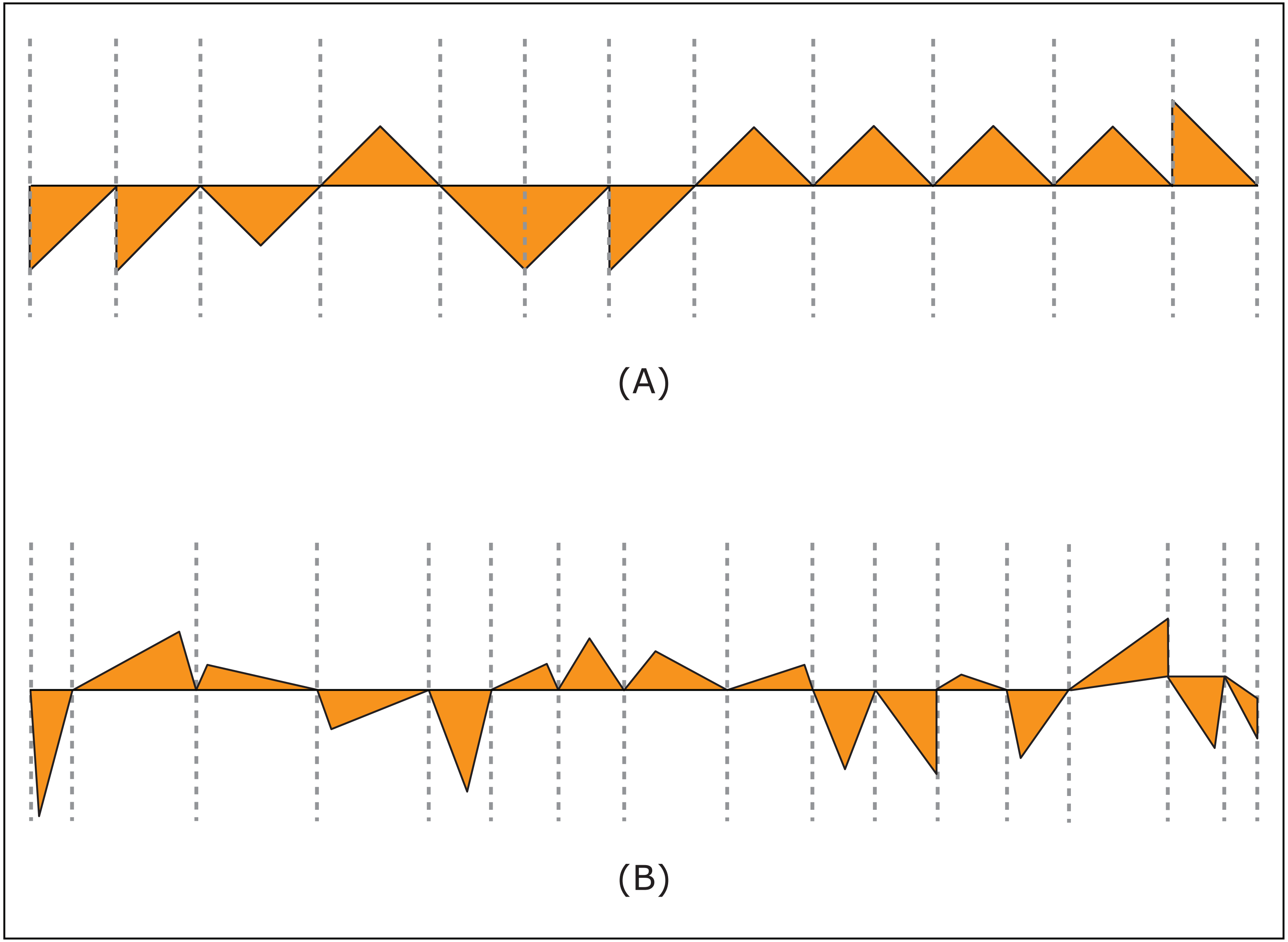
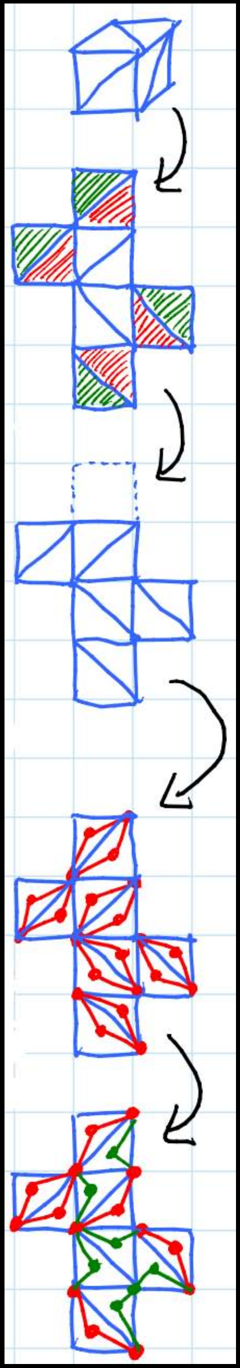


Image by MIT OpenCourseWare.
See also http://erikdemaine.org/papers/VertexUnfolding_Kuperberg2003/.

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

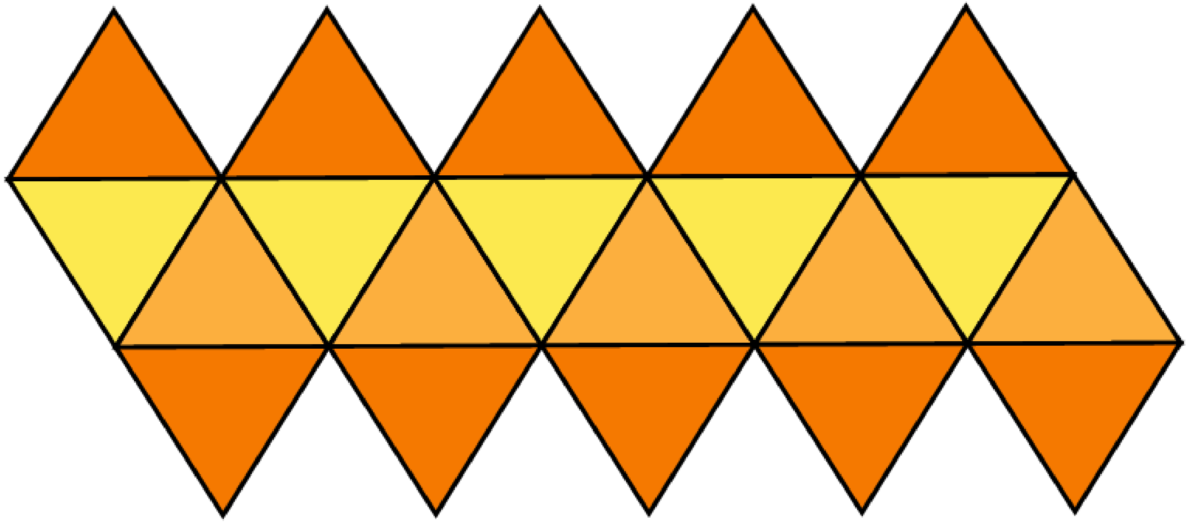
Figures of unfoldings removed due to copyright restrictions.
Refer to: Fig. 1-4 from Demaine, E. D., and A. Lubiw. "A Generalization of the Source Unfolding of Convex Polyhedra." *Revised Papers from the 14th Spanish Meeting on Computational Geometry, Lecture Notes in Computer Science* 7579 (2011): 185–99.

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?



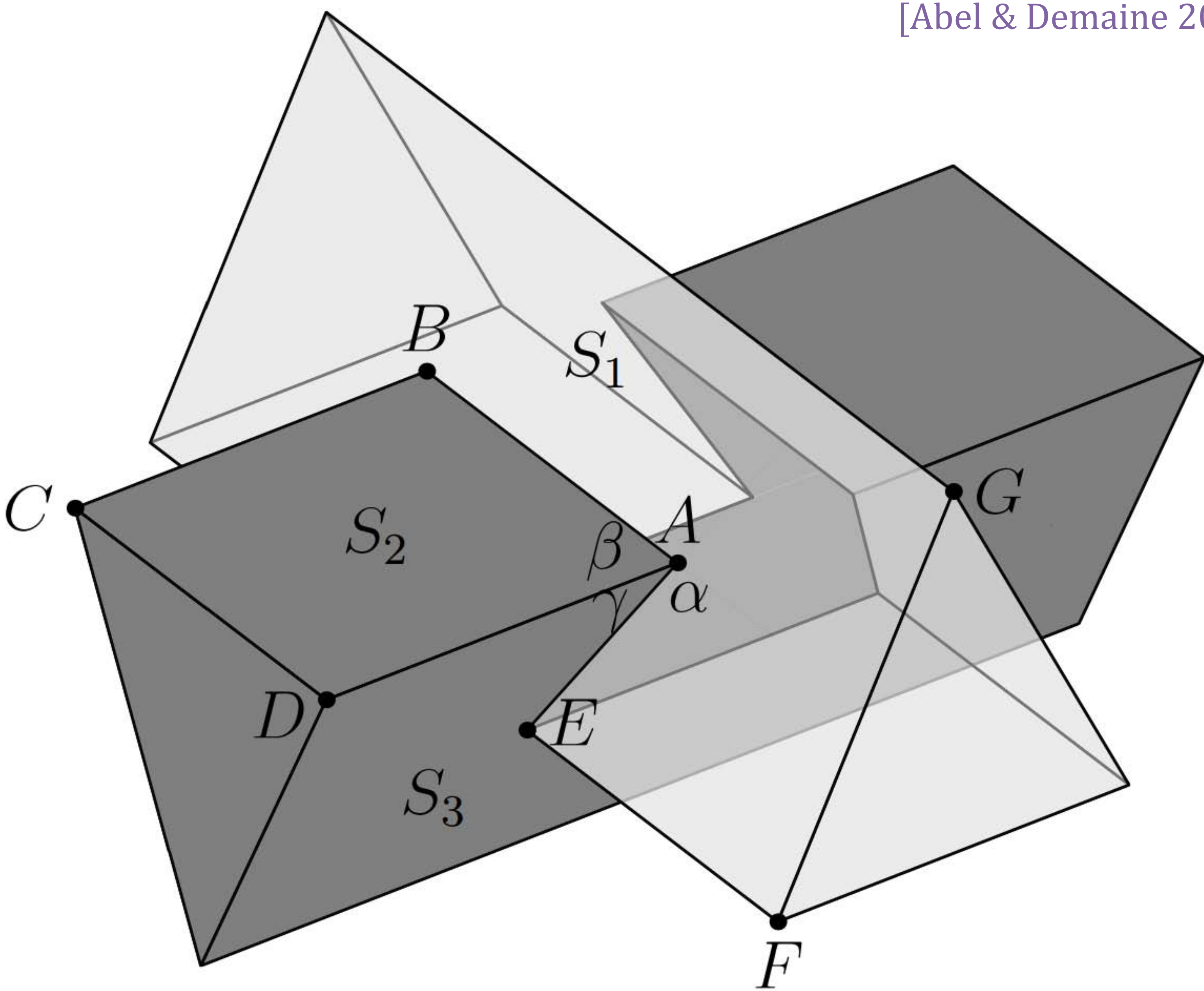
http://en.wikipedia.org/wiki/Icosahedron

Image of icosahedron removed due to copyright restrictions.

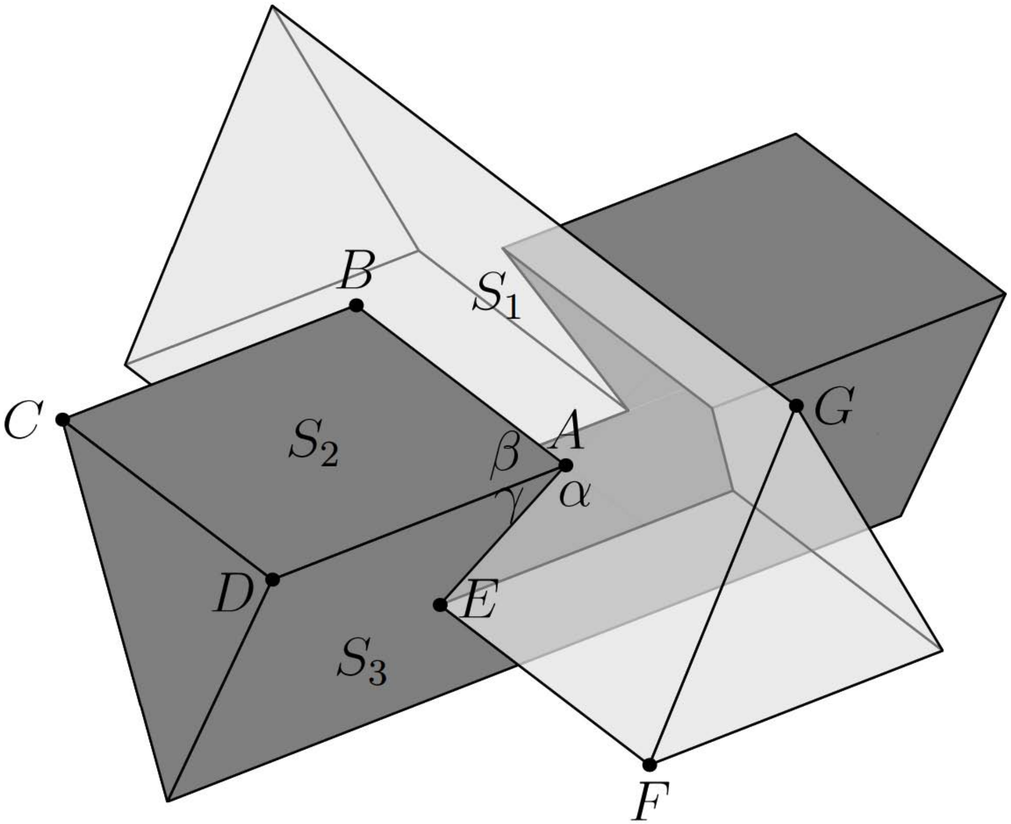


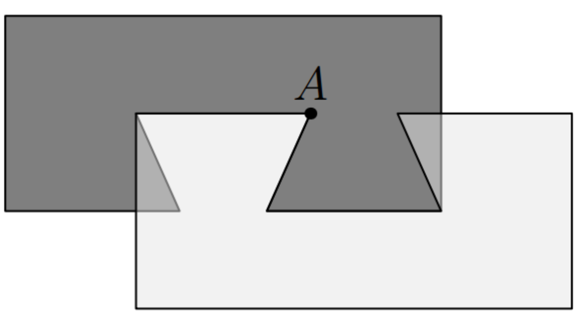
Any progress on vertex unfolding?

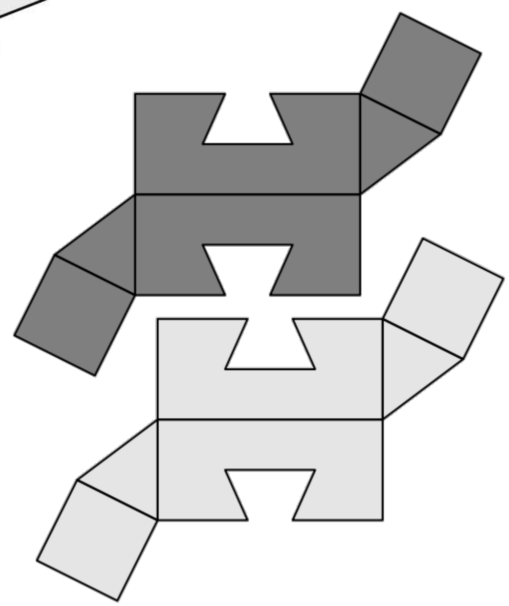
[Abel & Demaine 2011]

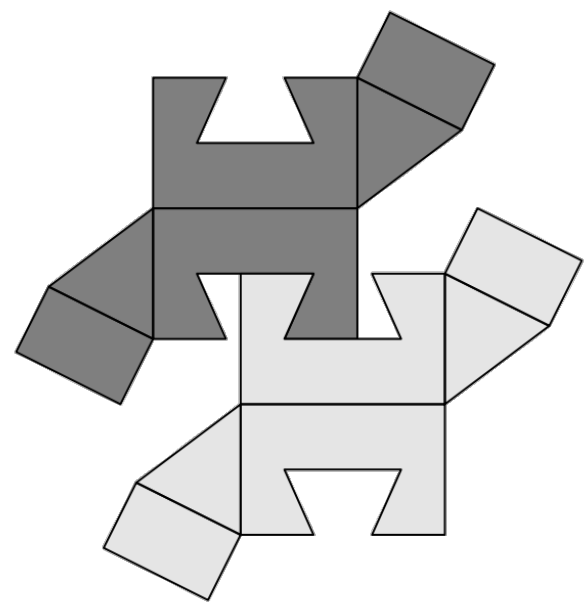


[Abel & Demaine 2011]

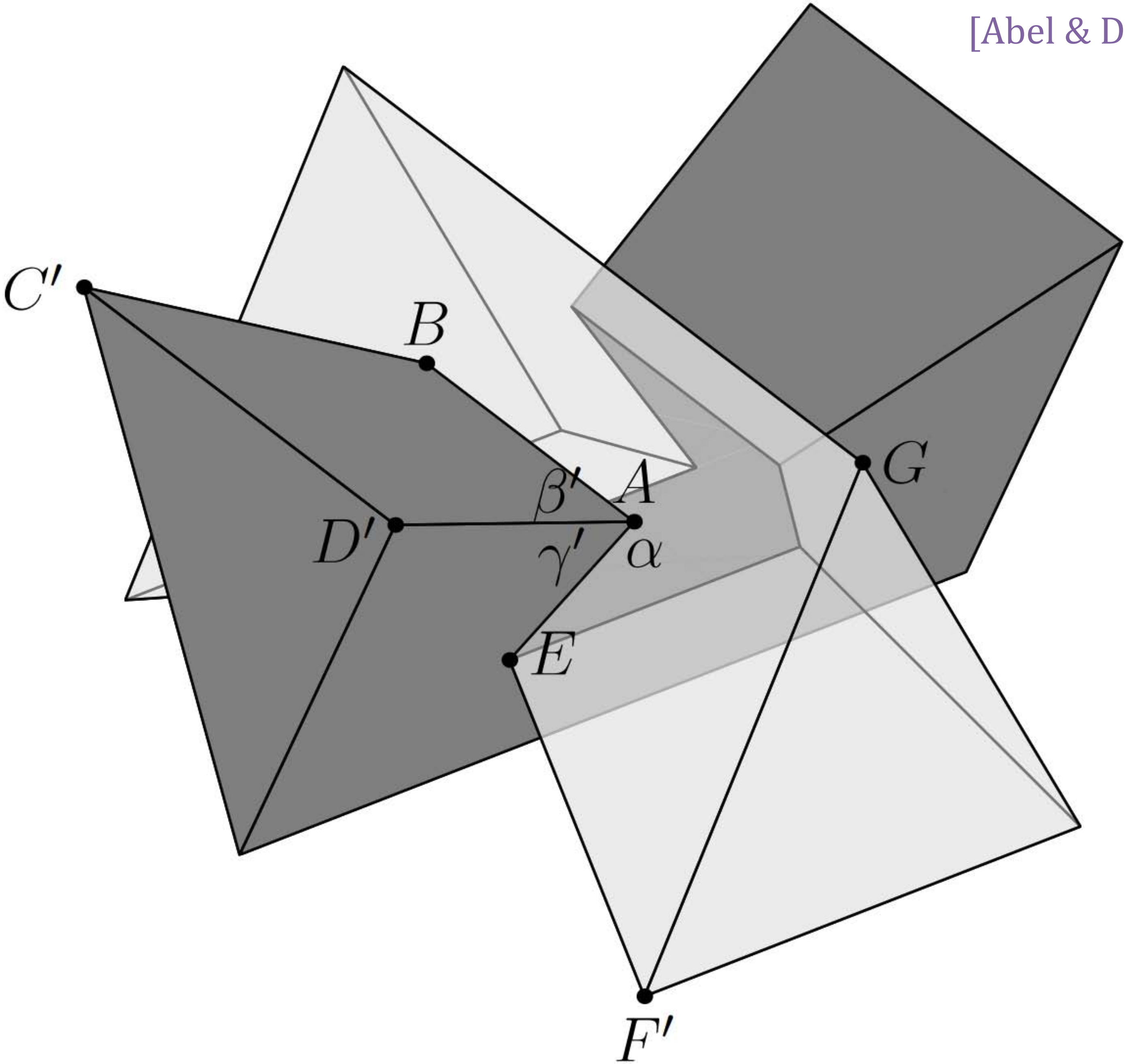








[Abel & Demaine 2011]



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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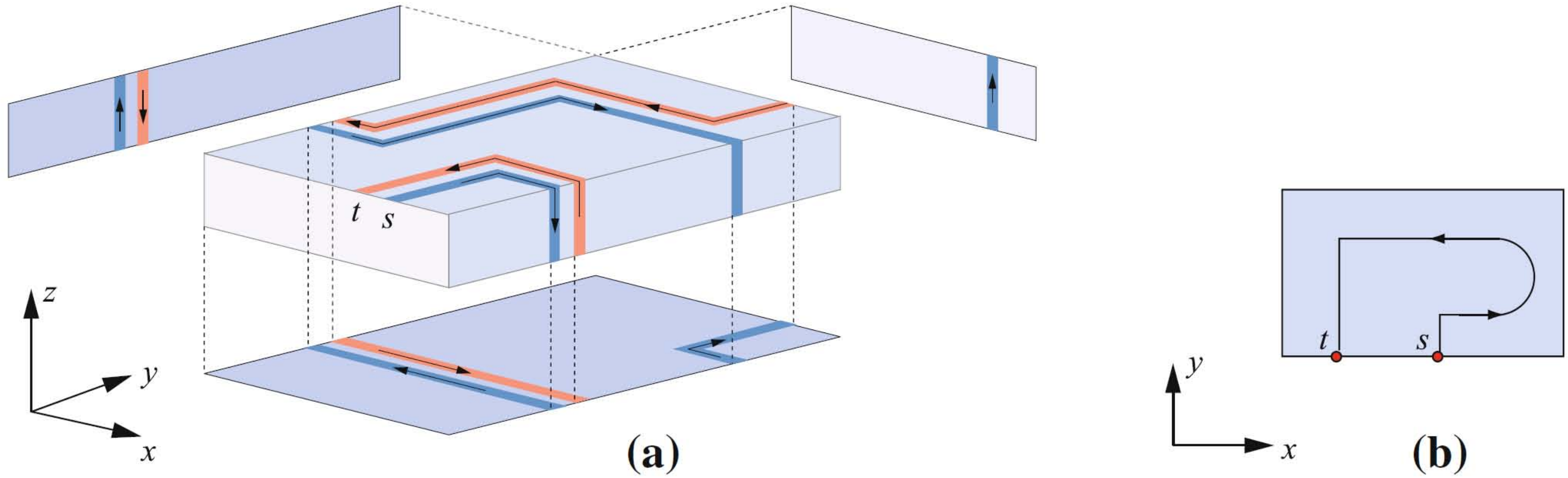
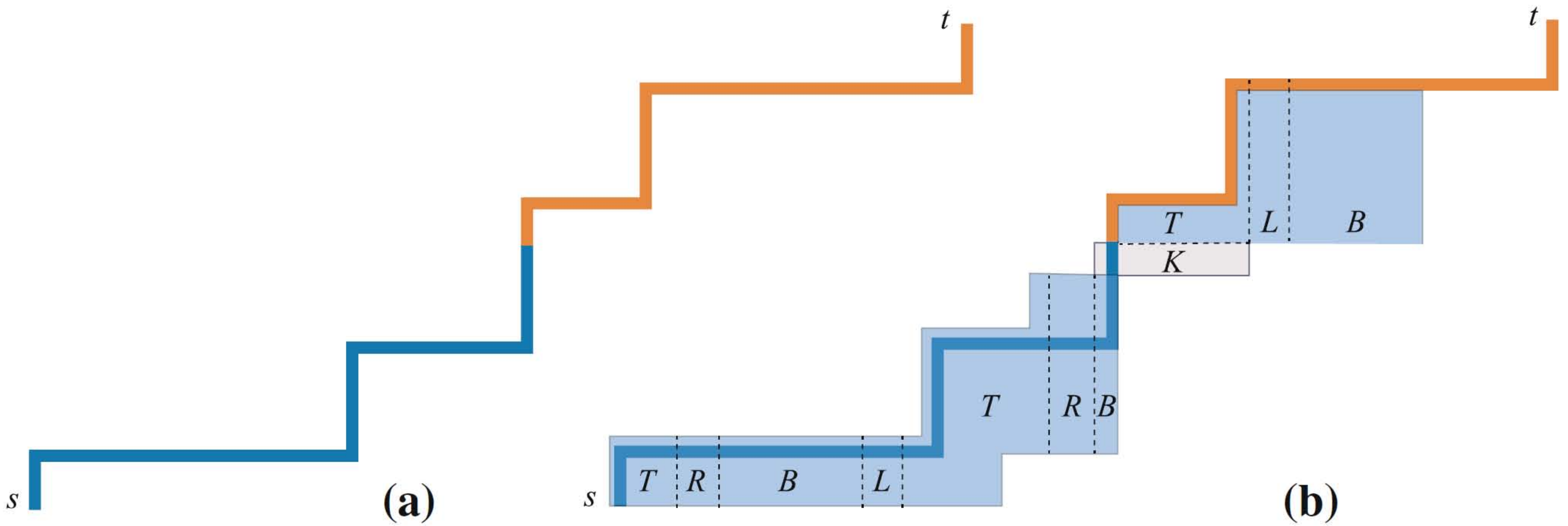
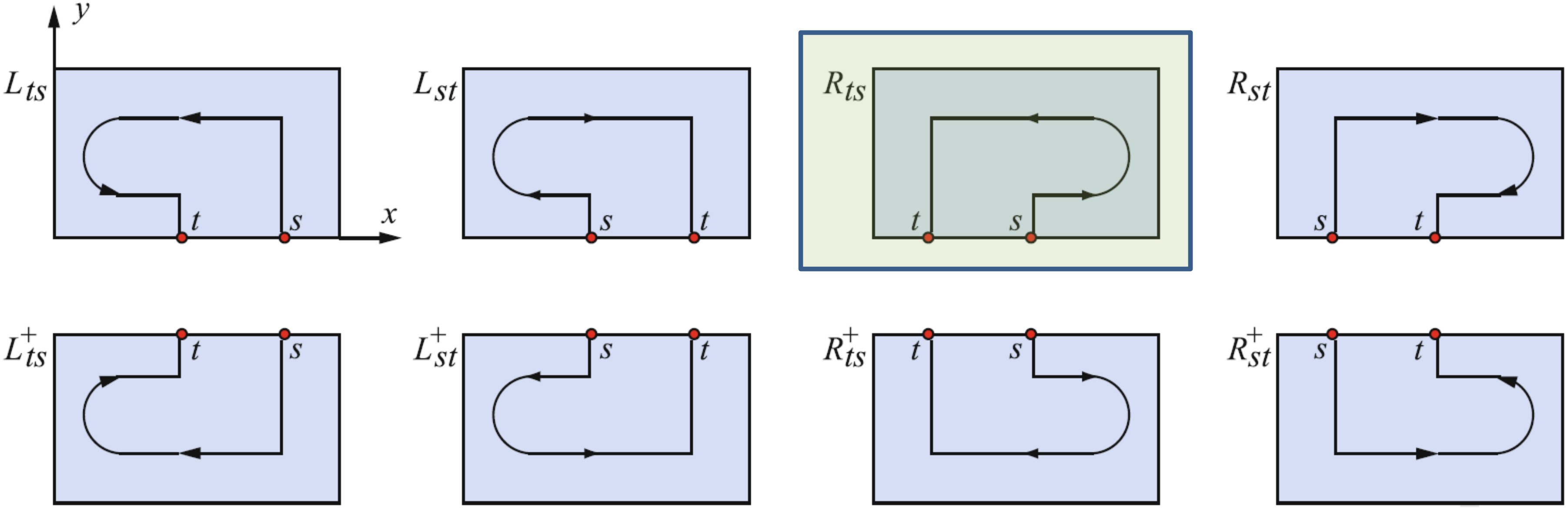
Abstract. We show that every orthogonal polyhedron homeomorphic to a sphere can be unfolded without overlap while using only polynomially many (orthogonal) cuts. By contrast, the best previous such result used exponentially many cuts. More precisely, given an orthogonal polyhedron with n vertices, the 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.

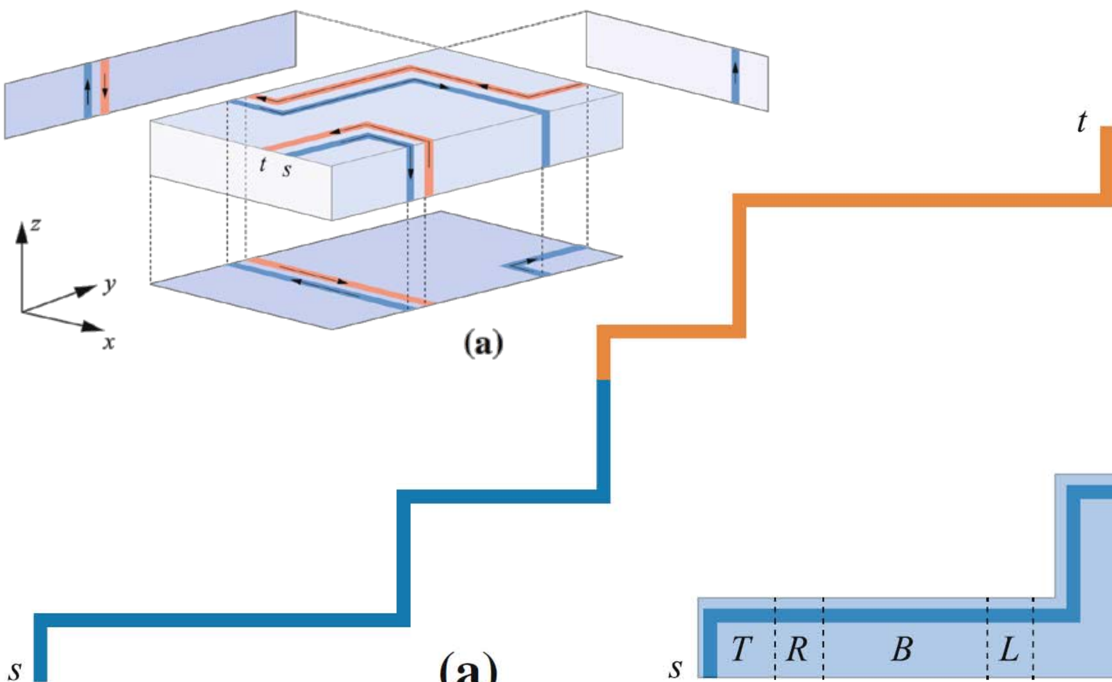
Key words. general unfolding, grid unfolding, grid refinement, orthogonal polyhedra, genus-zero

[Damian, Flatland, O'Rourke 2012]



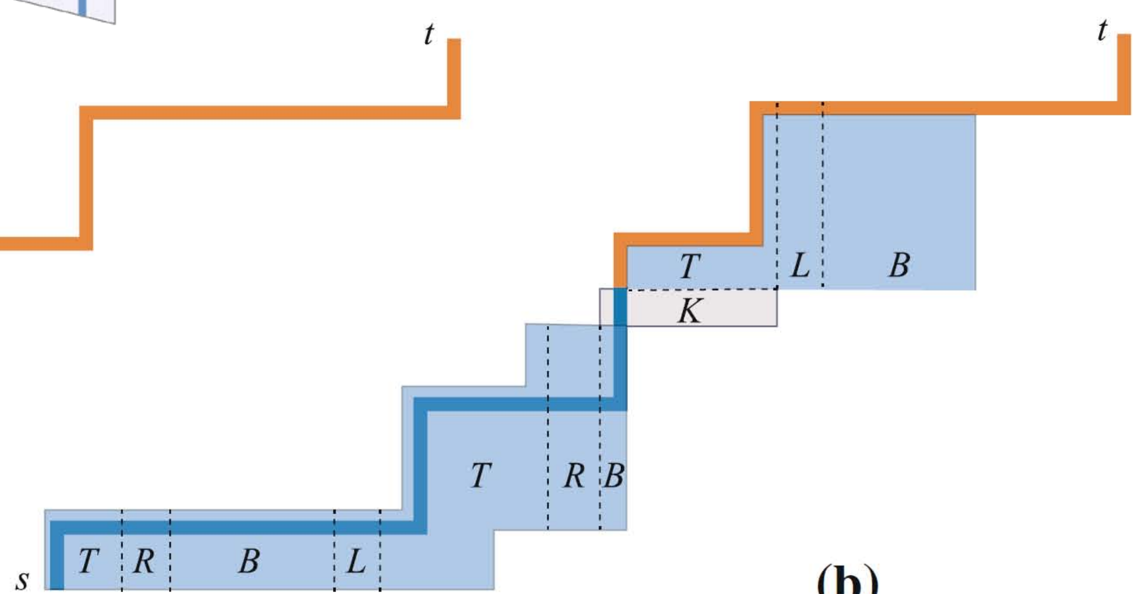






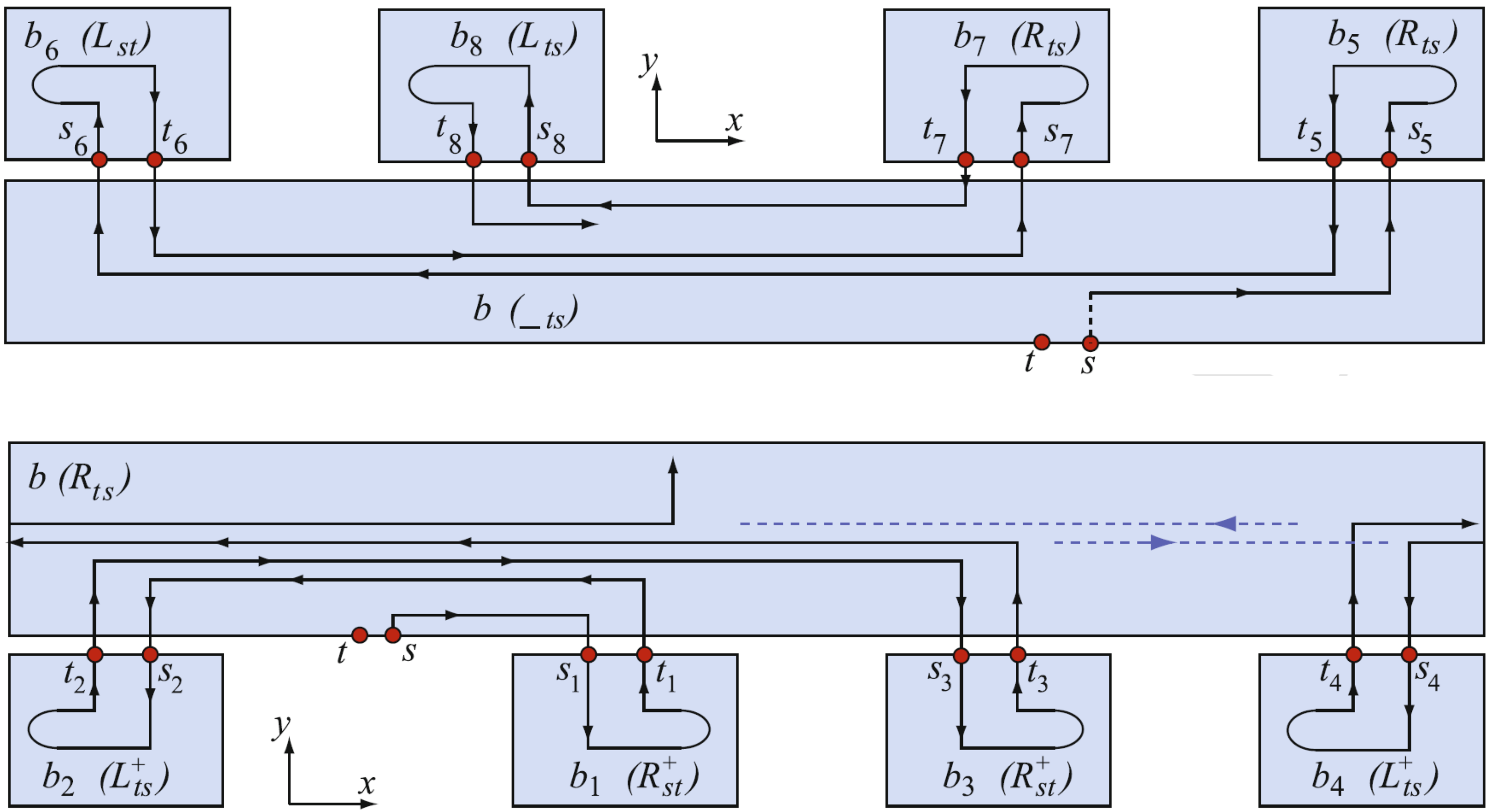
(a)

[Damian, Flatland, O’Rourke 2012]

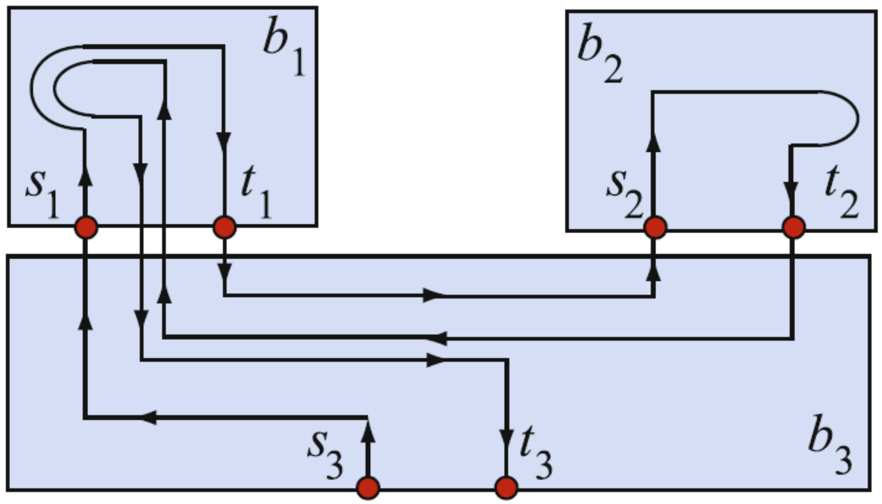


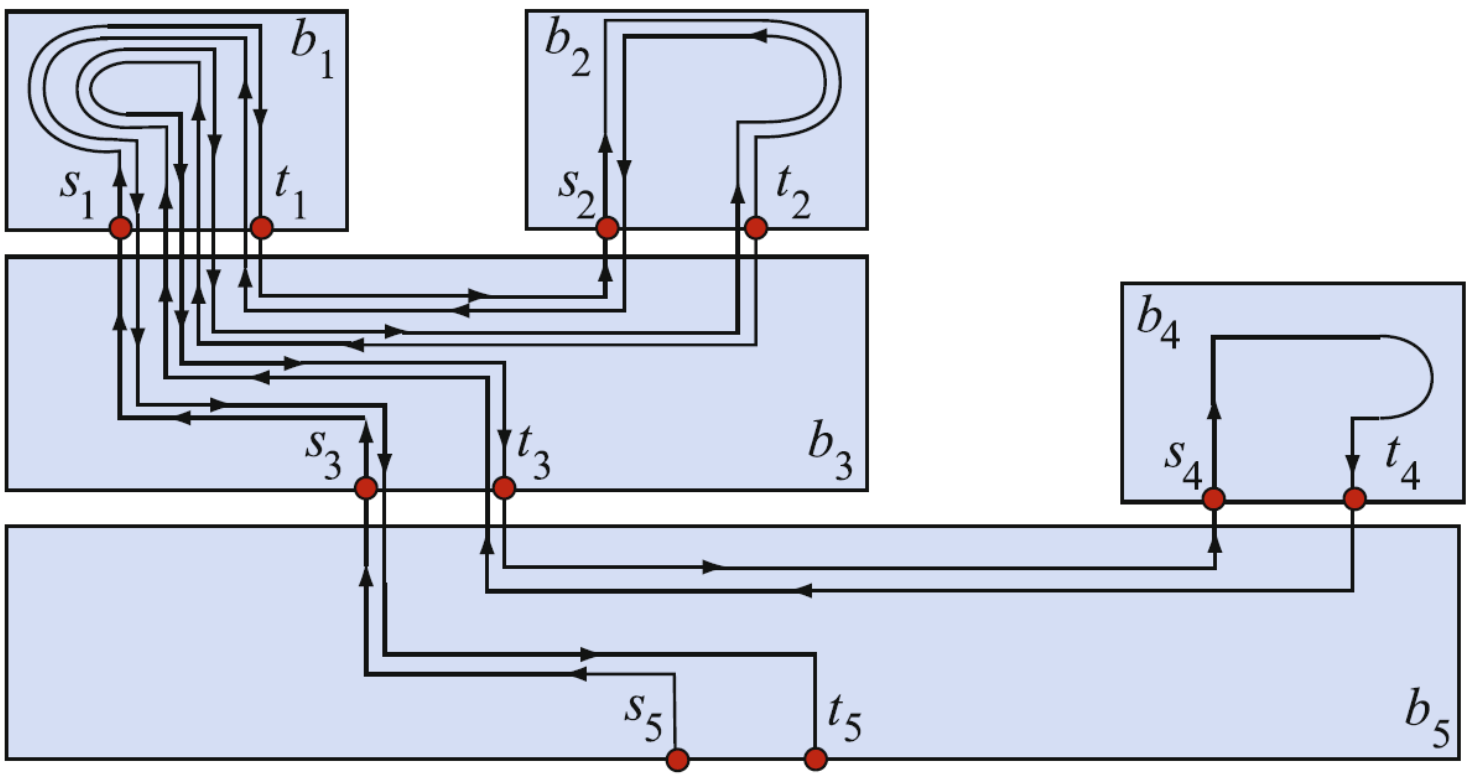
(b)

[Damian, Flatland, O'Rourke 2012]

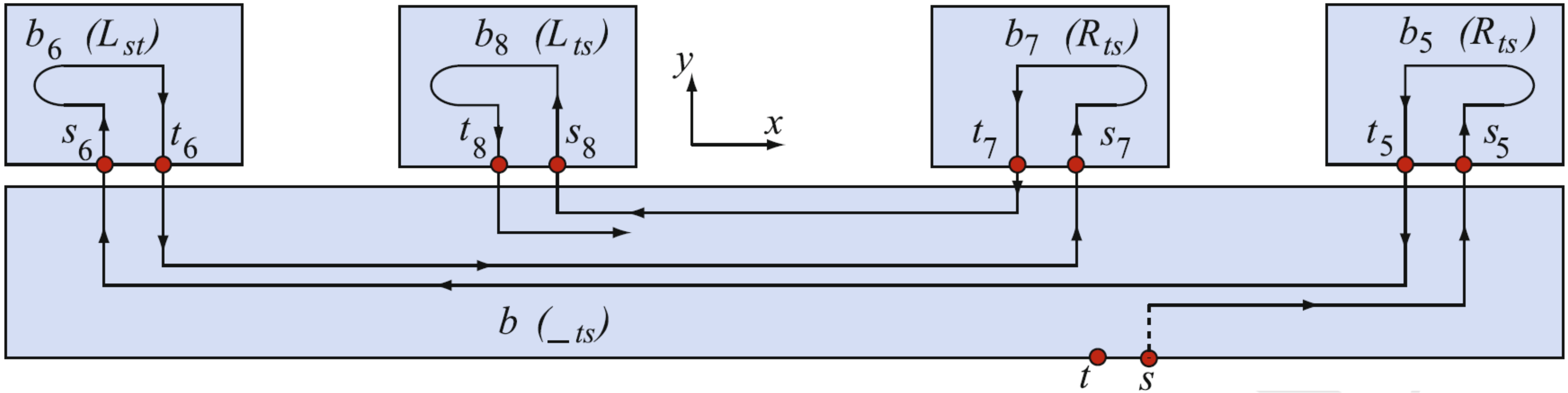


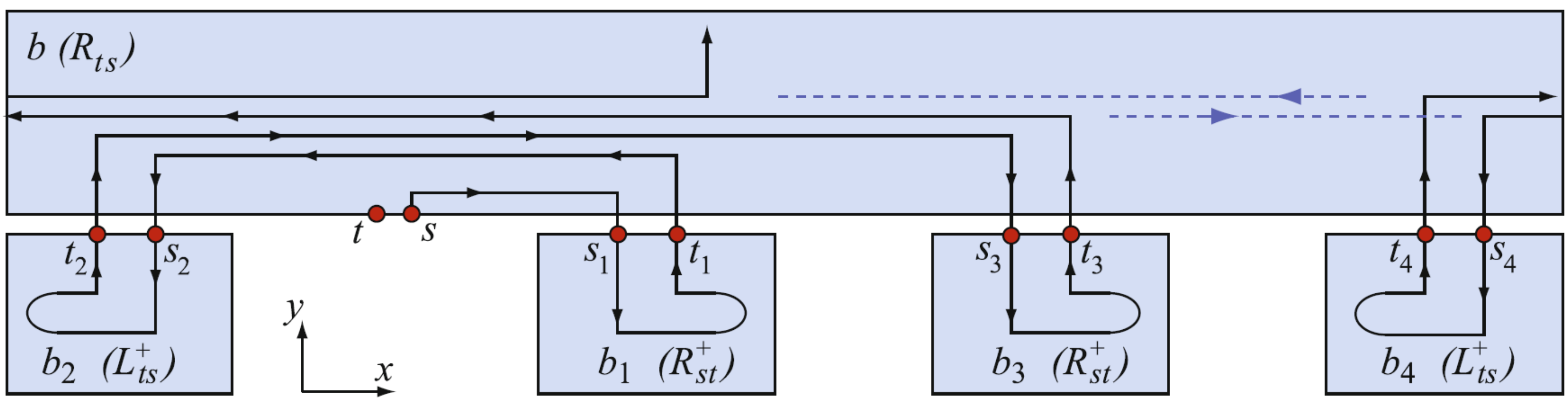
[Damian, Demaine, Flatland 2012]





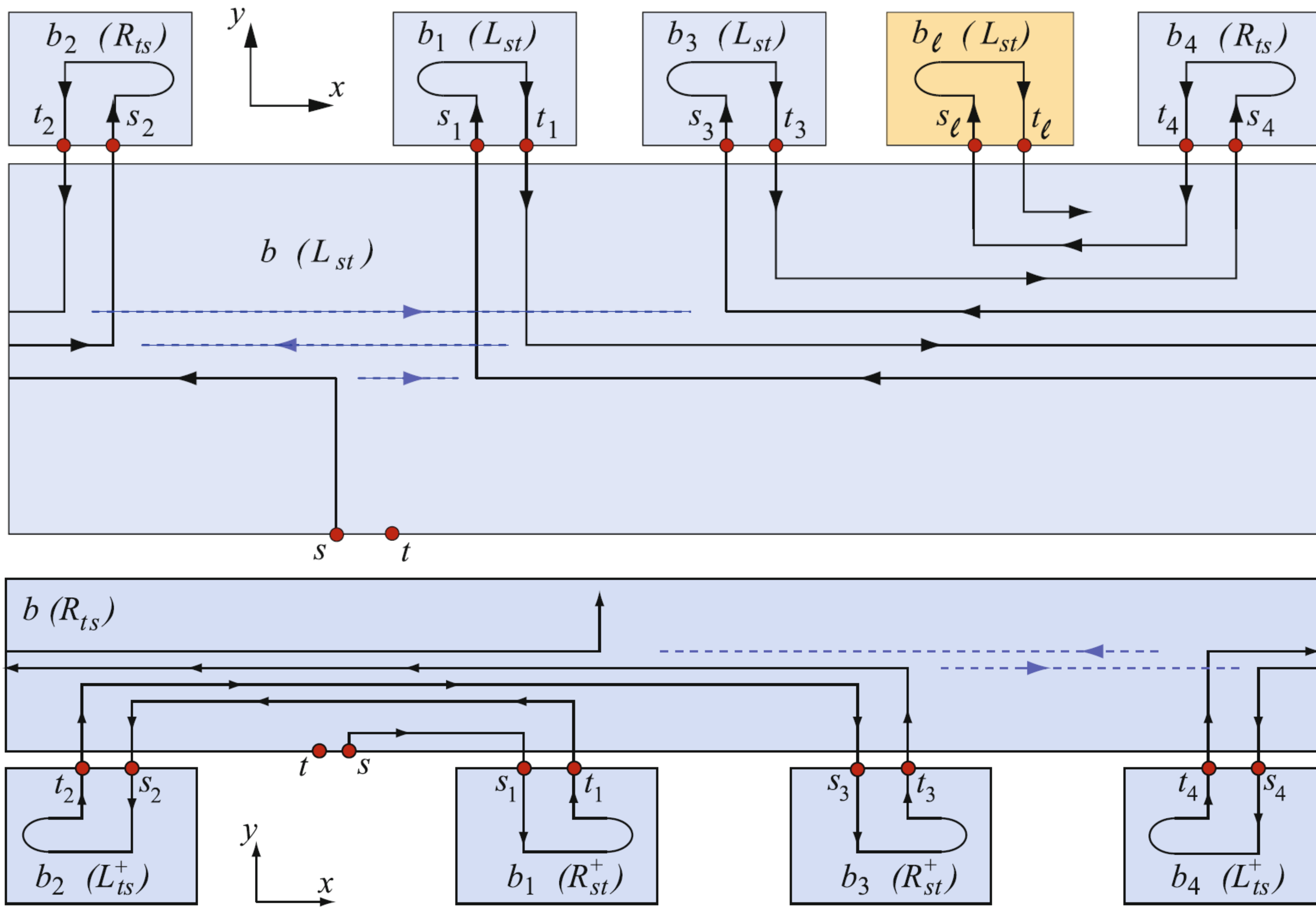
[Damian, Demaine, Flatland 2012]



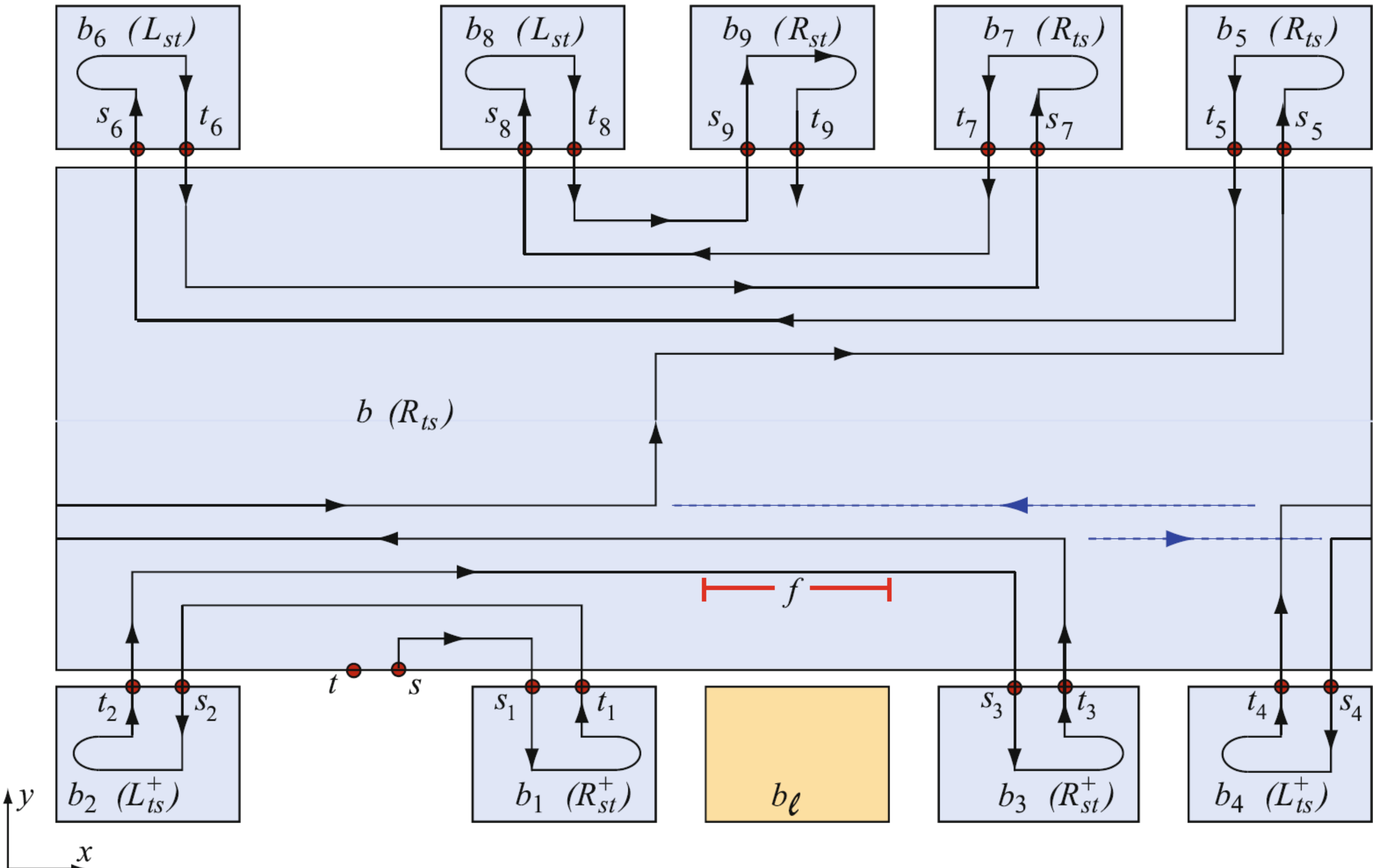


Courtesy of Mirela Damian, Erik D. Demaine, and Robin Flatland. Used with permission.

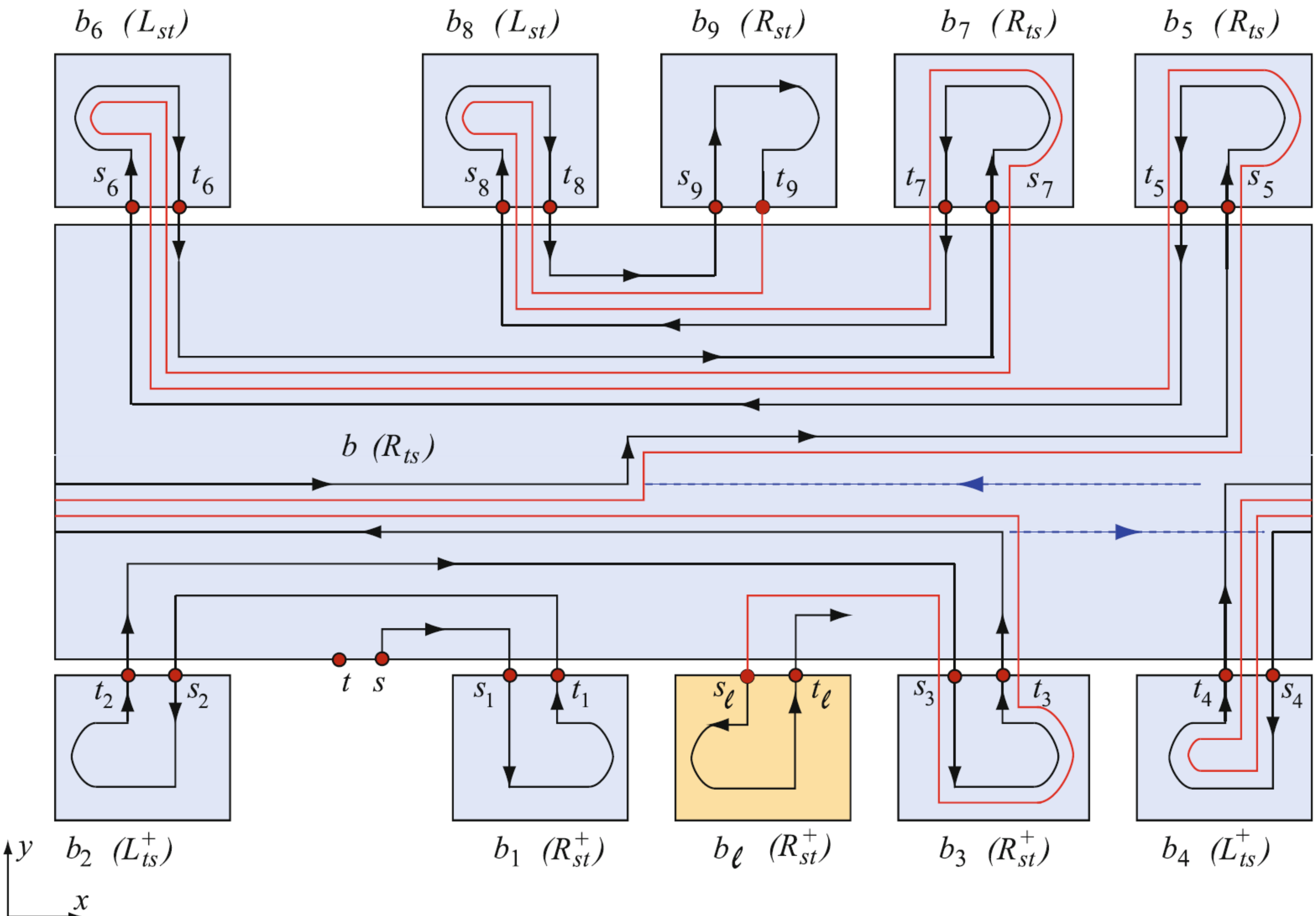
[Damian, Demaine, Flatland 2012]



[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" instructions written by Klaus Steffen removed due to copyright restrictions.
Refer to: http://www.math.cornell.edu/~connelly/Steffen.pdf.
See also http://demonstrations.wolfram.com/SteffensFlexiblePolyhedron/.

Image of deformation of a flexible surface removed due to copyright restrictions.
Refer to: http://www.mathematik.com/Steffen/.

[Steffen 1977]

Courtesy of Tom Gearty. Used with permission. To view video: http://www.youtube.com/watch?v=9h1Og9KdL08 and http://www.youtube.com/watch?v=Y47ZTc3lSvk.

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