Paper Title

C. J. H. Dickens, G. Orwell, G. R. R. Martin

Abstract: *The abstract must summarise the main content of the paper, and may be up to approximately 100 words in length. Unlike previous OSME publications, the abstract will be included in the proceedings. This abstract needs not be the same as that submitted for acceptance to the conference.*

1 Introduction

Outline

- Extruded Surfaces
- Cross Sections
- Orthogonal graphs
- Extruded Polygons
  - Convex Polygons
  - Concave Polygons

2 Extruded Surfaces

3 Cross Sections

We introduce a new method of origami construction, using cross section disgrams. Instead of beginning our construction from a 2-dimensional sheet of paper, we consider a 1-dimensional cross section moving forwards in time. A simple example is demonstrated in Figure 1.

3.1 Evolution

Segments and Velocities

Evolution of Adjacent Segments

Creation of New Segments

4 Orthogonal Graphs

In this section, we outline a construction of orthogonal graphs with arbitrary rational extrusion heights. In our construction, the cross section at will always be on the $x-z$ plane. This makes the analysis much simpler.

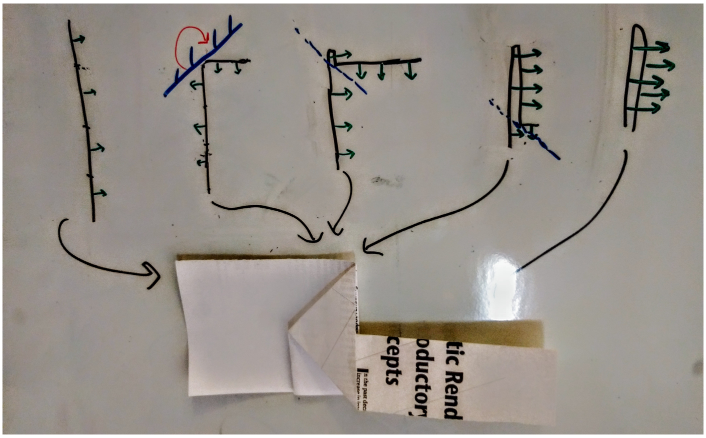

Figure 1: *A strip narrowing gadget constructed from cross sections.*

4.1 Grid Extrusion

To simplify the presentation, we will consider an uniform $X-Y$ grid, with arbitrary rational extrusion heights corresponding to every grid square.

Definition 1. *An $n \times m$ rational grid extrusion is a 3-dimensional structure, whose projection onto the $x-y$ plane forms an unit grid of size $n \times m$. Additionally, the unit face corresponding to the location $(i.j)$, is extruded E_{ij} units in the z direction, where E_{ij} is a rational number.*

4.1.1 Strip Extrusion

We also consider each "column" of a given grid extrusion separately as an individual *strip exrusion*. We will construct each of the n strips independently, and attachthem together with *strip connectors*.

4.2 Optimality

Under some suitable assumptions, our construction can be made $2+\varepsilon$ optimal, for arbitrarily small ε.

We define the maximum deltas along the y-axis as $D_j = \max_i \|E_{i,j} - E_{i,j+1}\|$, and let $Y = n + \sum_{i=1}^{n-1} D_j$ We also define the lowest and highest points along x-axis as $L_i = \max_j E_{ij}$ and $H_i = \max_j E_{ij}$, and let

$$X = n + \sum_{i=1}^{n} \left[(H_i - \min(L_i, L_{i+1})) + (H_i - \min(L_i, L_{i-1})) \right]$$

The terms in the summation account for the total length of all the necessary worst case vertical walls, and the n is for the top faces.

Claim 2. *The x-axis length of the strip of paper required to fold this shape can be made arbitrarily close to X.*

Claim 3. *The y-axis length of the strip of paper required to fold this shape will be exactly Y.*

First, we pick an ε, such that 2ε divides all extrusion heights. The construction will require paper of size $X' \times Y$, where $X' = X + 2\varepsilon(n-1)$.

There are two components to the construction

- n strips parallel to the y-axis. Each of these strips will fold to the corresponding strip in the extruded graph. The total area of these strips will be $X \times Y$.
- $n-1$ Intermediate strips, each of size $2\varepsilon \times Y$ to connect the main strips together.

The total area is therefore $X \times Y + (n-1)2\varepsilon \times Y = X' \times Y$. This can of course be made arbitrarily close to $X \times Y$.

5 Polygons

References

Name of First Author
Name, Address of Institute, e-mail: name@email.address

Name of Second Author
Name, Address of Institute, e-mail: name@email.address