Origami as Computer Science
Ryuhei UEHARA (uehara@jaist.ac.jp)

- Origami

1. Introduction

“Origami” is the name of paper folding and it is a famous traditional art in Asia.

You may think that origami is childish, but recent origami is very fine and a kind of art:

- “Devil” designed by Jun Maekawa.
- “Rose” designed by Toshikazu Kawasaki.
- “Shell” designed by Toshikazu Kawasaki.
- “Spring” designed by Jeff Beynon in UK!!

Recently, “Origami” is known as one of hot topics that is not only art but also science --- mathematics, computer science --- and that has wide applications including architecture, bioinformatics, and so on…

It can be stretched like spring…

...viewpoint of “Arithmetic”

- “Ammonite” designed by Jun Maekawa.

It can be “self-organized”…

- “Huzita-Hatori axiom” contains seven basic folding operations.

Using simple operations, we can solve some “difficult problem” like “trisector any given angle” that is impossible using rule and compass.

…viewpoint of “Algorithm”

- We can find a best (or better) way to fold efficiently (by computer) for simple nets.

2.2. Negative Results

- It is intractable to find a way to fold some nets in general.

...viewpoint of “Computational Complexity”

- “Huzita-Hatori axiom” contains seven basic folding operations.

Using simple operations, we can solve some “difficult problem” like “trisector any given angle” that is impossible using rule and compass.

…viewpoint of “Arithmetic”

- We can find a flat folding efficiently if it exists …

...even if it is a kind of complex.

- It can be folded along curves…

- “Ammonite” designed by Jun Maekawa.

…viewpoint of “Computational Complexity”

2.1. Positive Results

- We can find a best (or better) way to fold efficiently (by computer) for simple nets.

…viewpoint of “Algorithm”

2.0. Basic Operations

- “Huzita-Hatori axiom” contains seven basic folding operations.

Using simple operations, we can solve some “difficult problem” like “trisector any given angle” that is impossible using rule and compass.

…viewpoint of “Algorithm”

- We can find a flat folding efficiently if it exists …

...even if it is a kind of complex.

- It can be folded along curves…

- “Ammonite” designed by Jun Maekawa.

…viewpoint of “Computational Complexity”

2.2. Negative Results

- It is intractable to find a way to fold some nets in general.

...viewpoint of “Computational Complexity”

- “Huzita-Hatori axiom” contains seven basic folding operations.

Using simple operations, we can solve some “difficult problem” like “trisector any given angle” that is impossible using rule and compass.

…viewpoint of “Algorithm”

- We can find a flat folding efficiently if it exists …

...even if it is a kind of complex.

- It can be folded along curves…

- “Ammonite” designed by Jun Maekawa.

…viewpoint of “Computational Complexity”

2.1. Positive Results

- We can find a best (or better) way to fold efficiently (by computer) for simple nets.

…viewpoint of “Algorithm”

2.0. Basic Operations

- “Huzita-Hatori axiom” contains seven basic folding operations.

Using simple operations, we can solve some “difficult problem” like “trisector any given angle” that is impossible using rule and compass.

…viewpoint of “Algorithm”

- We can find a flat folding efficiently if it exists …

...even if it is a kind of complex.

- It can be folded along curves…

- “Ammonite” designed by Jun Maekawa.

…viewpoint of “Computational Complexity”

2.2. Negative Results

- It is intractable to find a way to fold some nets in general.

...viewpoint of “Computational Complexity”

- “Huzita-Hatori axiom” contains seven basic folding operations.

Using simple operations, we can solve some “difficult problem” like “trisector any given angle” that is impossible using rule and compass.

…viewpoint of “Algorithm”

- We can find a flat folding efficiently if it exists …

...even if it is a kind of complex.

- It can be folded along curves…

- “Ammonite” designed by Jun Maekawa.