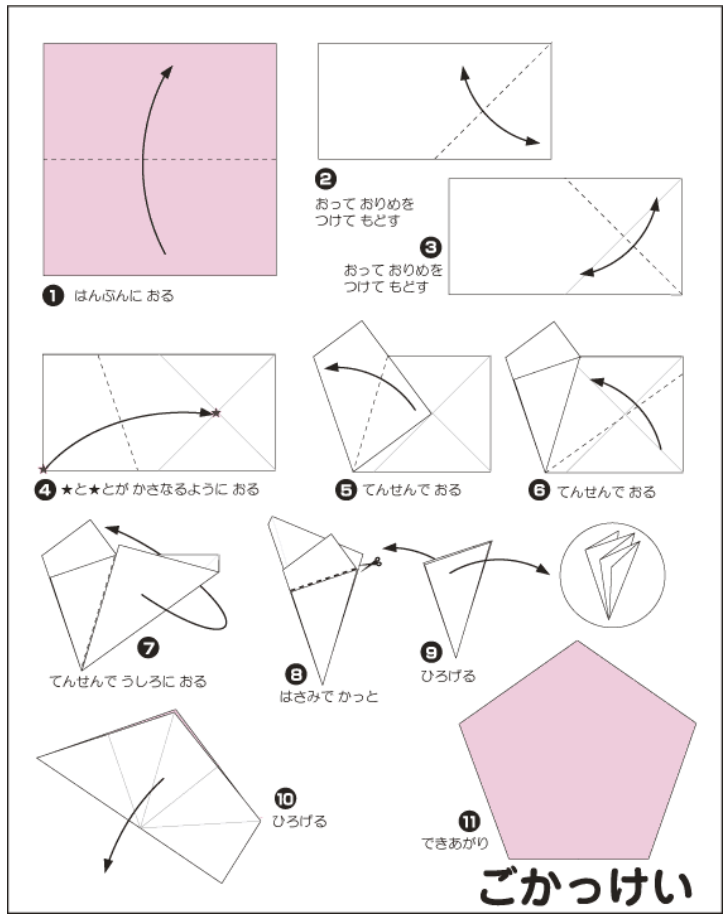
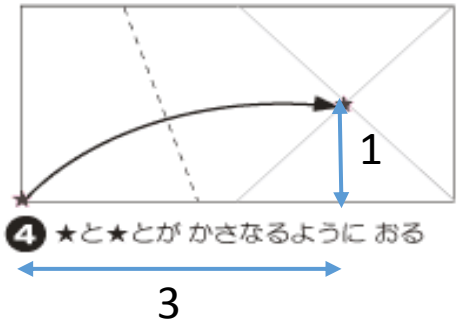
Origami – the ART and SCIENCE of paper folding

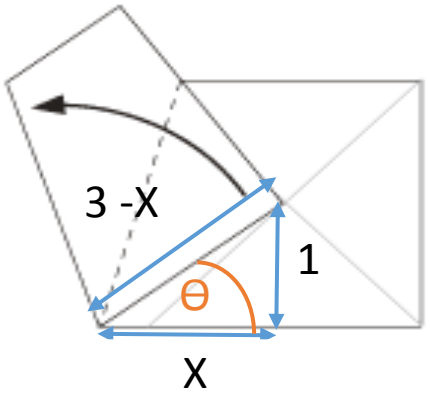
Dennis Li

2018

Geometry behind cutting a pentagon







In a pentagon, angle θ = 36 degree

$1^2 + X^2 = (3 - X)^2$

$X = 4 / 3$

$3 - X = 5 / 3$

$\tan \theta = 0.75$

$\theta = 36.87$ degree

(close enough)

Question : How can someone come up with this ingenious solution

Origami History

蔡倫造紙 63 – 121

Japanese painting – 1797

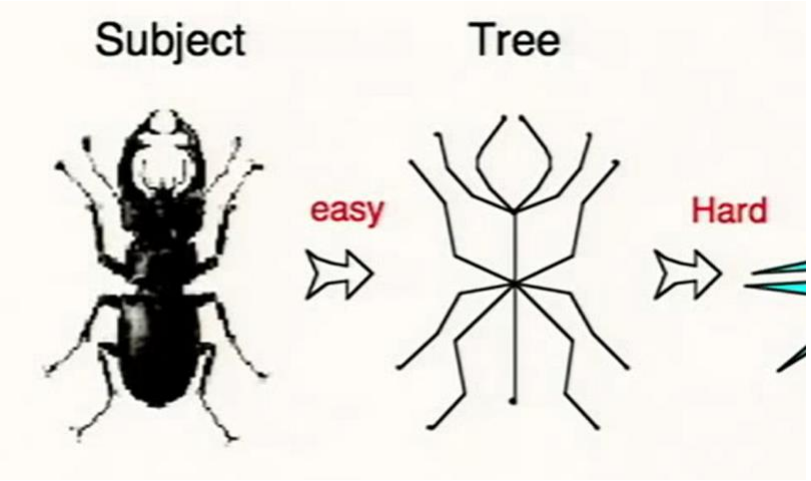
There are many famous
Origami artists from Japan

Origami Development

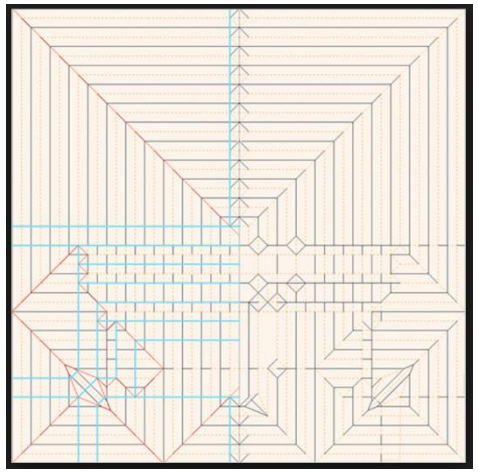
- First generation teaching is one on one and step by step
- 吉澤 章 Akira Yoshizawa 1911 – 2005 developed a standard convention in paper folding (mountain fold, valley fold, open sink, close sink, spread sink, inside reverse fold, outside reverse fold…etc) which allows paper models to be documented and folded by many
- In the 21st century, use of mathematics and computers speed up the theory and practice of origami

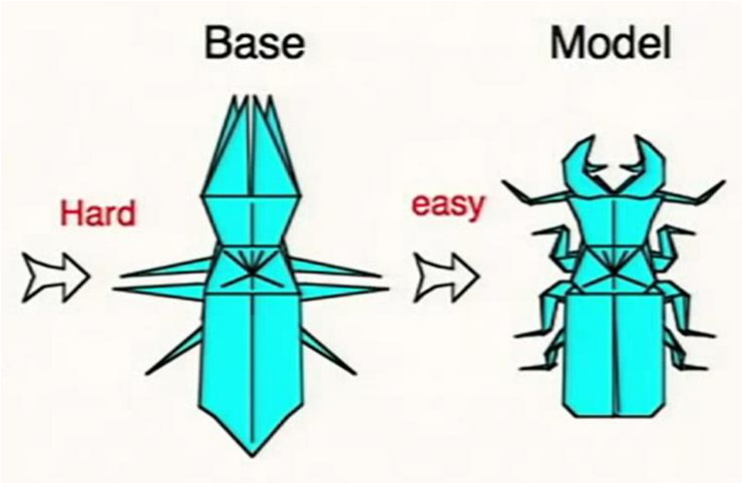
Robert Lang

- He pioneered the
  - – subject – stick figure – crease pattern – base model – formation approach



Crease pattern

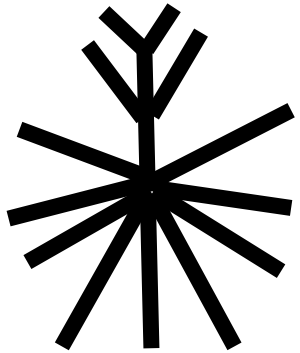




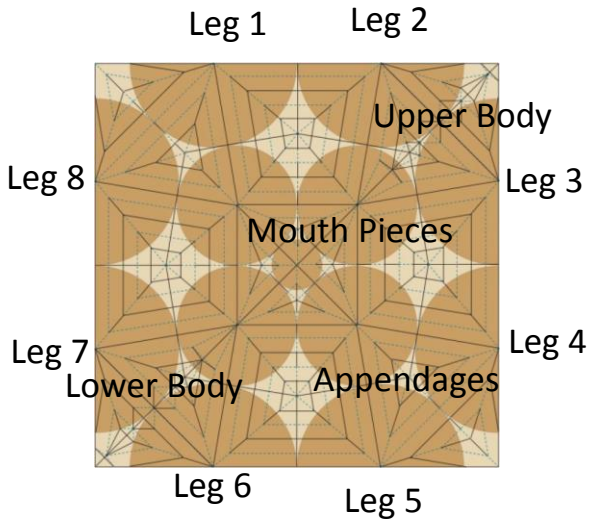
Another Example - Tarantula

Subject
8 Legs
2 Appendages
2 Mouth Pieces
Upper body
Lower body

Stick Figure



Crease Pattern



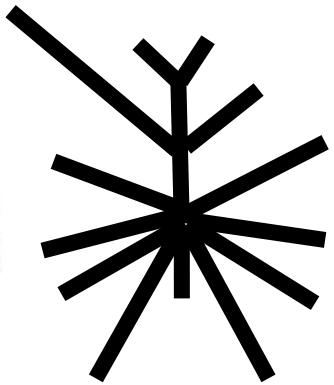
Collapsed Base Form

Finished Art Work

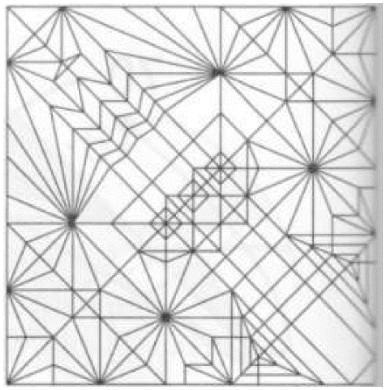
Another Example – Fiddler Crab

Subject
8 Legs
1 Large Craw
1 Small Craw
2 Eyes
Body

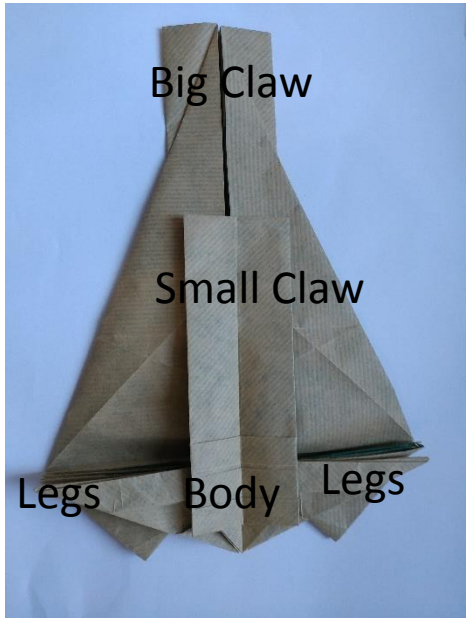
Stick Figure



Crease Pattern



Collapsed Base Form



Finished Art Work

How I become addicted to Origami

- In July 2015, while surfing the internet, I saw the following (UNBELIEVABLE!)

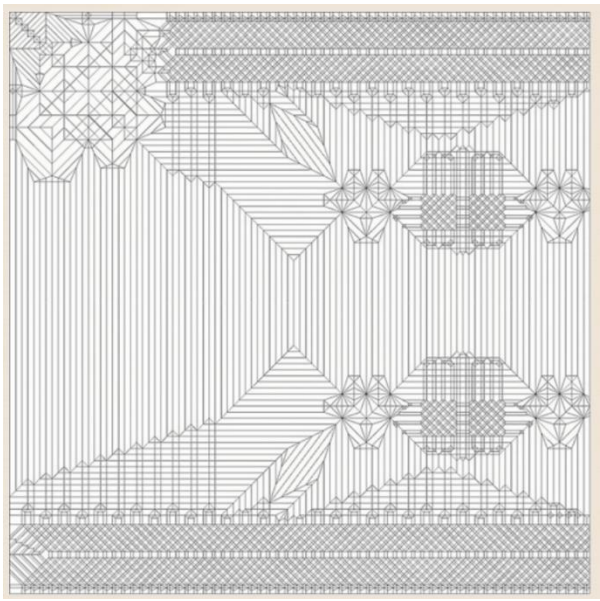
Ryujin龍神 3.5

神谷哲史 Satoshi Kamiya

Crease pattern of Ryujin龍神 3.5

from a single sheet of square paper

with a 96 X 96 grid

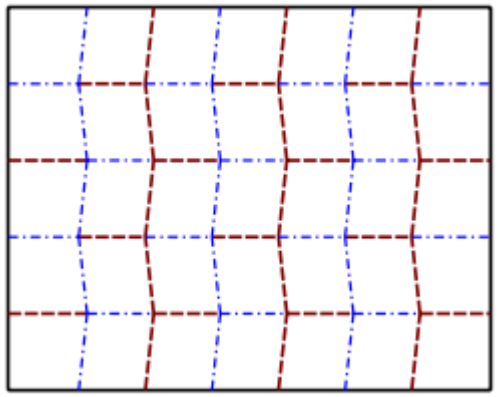


Fiery Dragon – Kade Chan (Hong Kong)

- I folded my first dragon model (fiery dragon by Kade Chan)
- My daughter shared it in Facebook and received a few likes
- I am in a path of no return

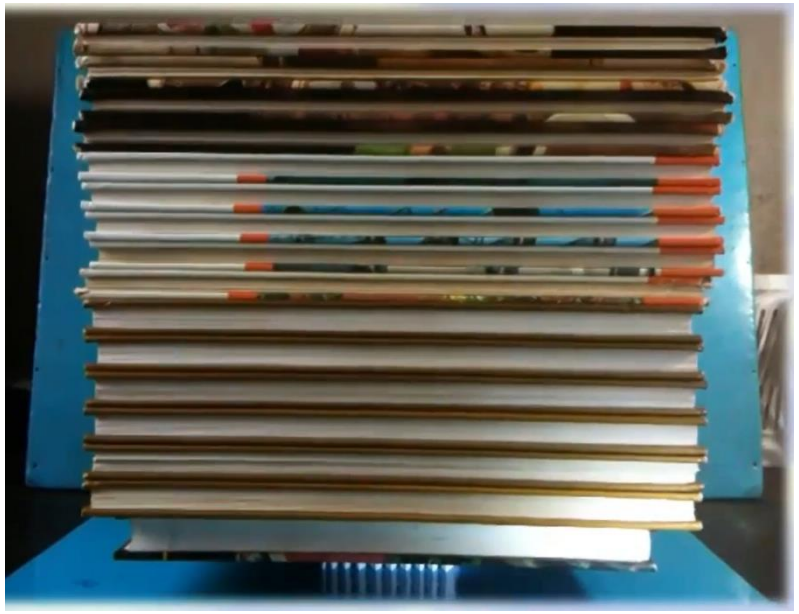
Where is the Science part of Origami?

- Miura Fold – applications in folding maps, solar panel and strengthening material



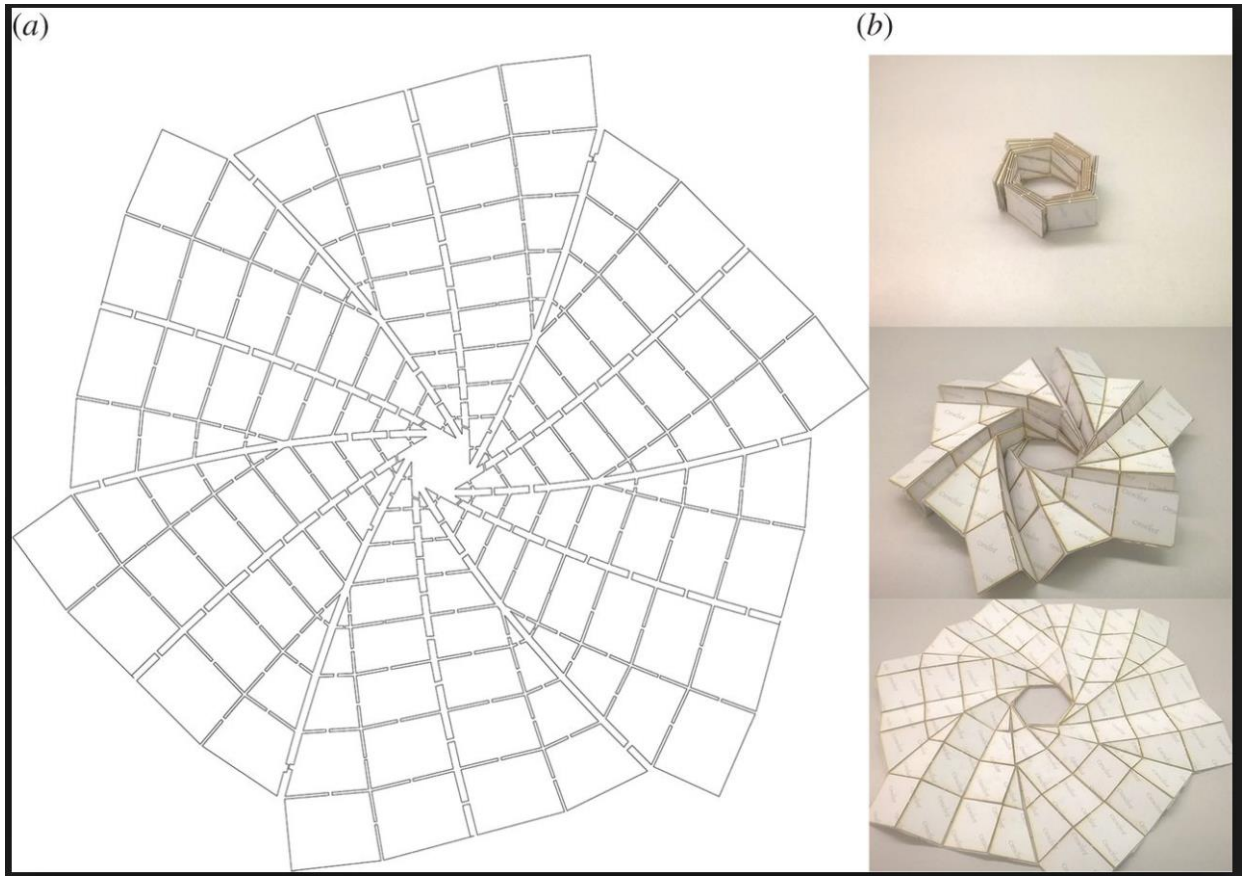
Miura folding stress test (youtube)

https://www.youtube.com/watch?v=mPpKjD2e8O8&t=56s

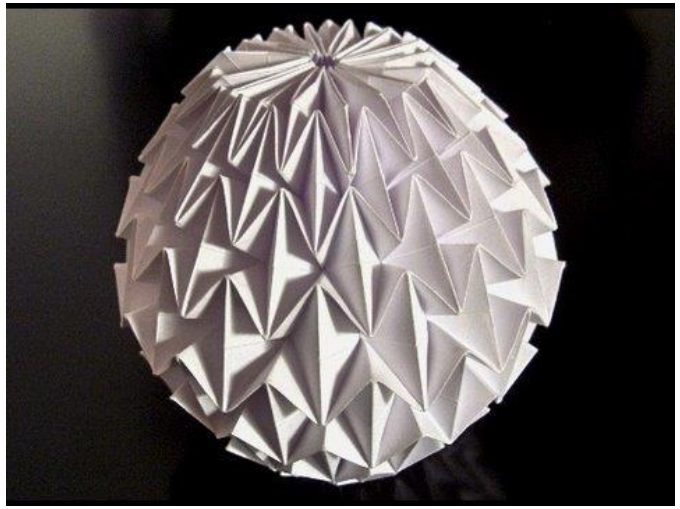


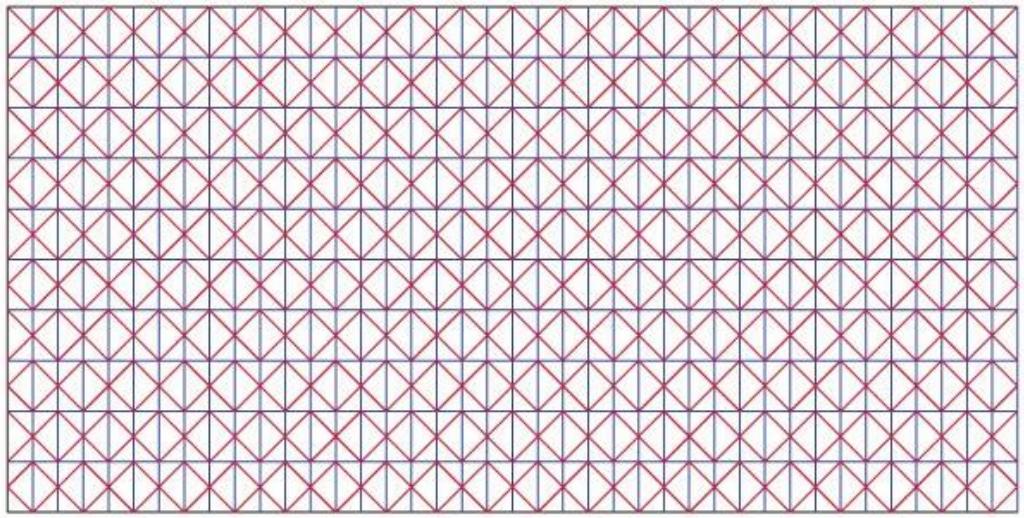
Origami in Space: BYU designed solar arrays

Minimum volume (payload restriction) and Maximum area and easy to unfold



Origami magic ball (water bomb construction)



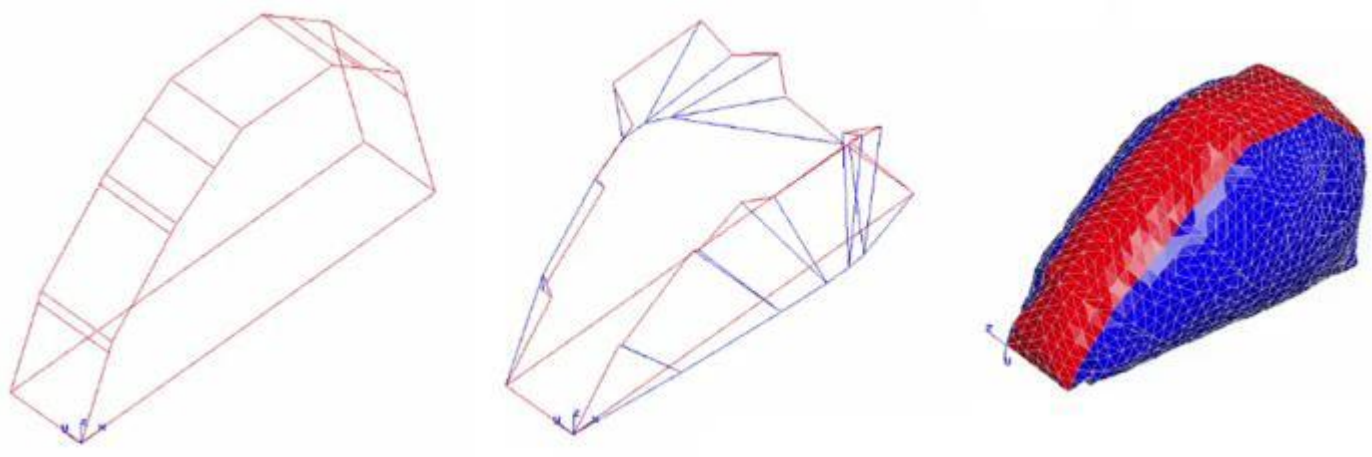


Water Bomb Origami – a Life Saving Device

- Kaori Kuribayashi-Shigetomi Folding the future with Origami
- Stent – small core can expand in size to unblock blood vessel

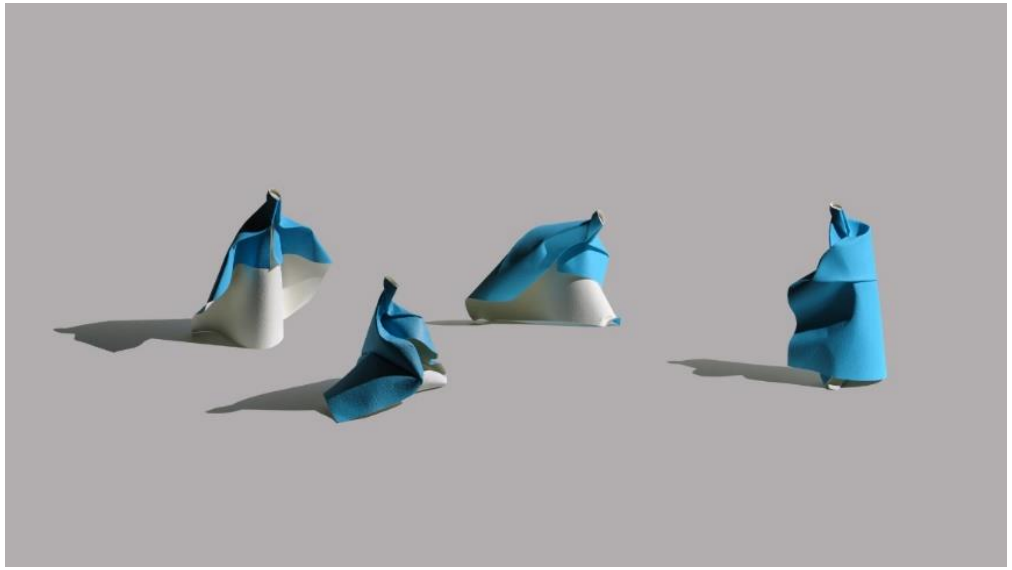
Another Life Saving Device - Airbag

Using origami simulation – can save a lot of time, effort and money



Famous Origamist – Dinh Giang

- Simple and Artistic



Famous Origamist – Satoshi Kamiya

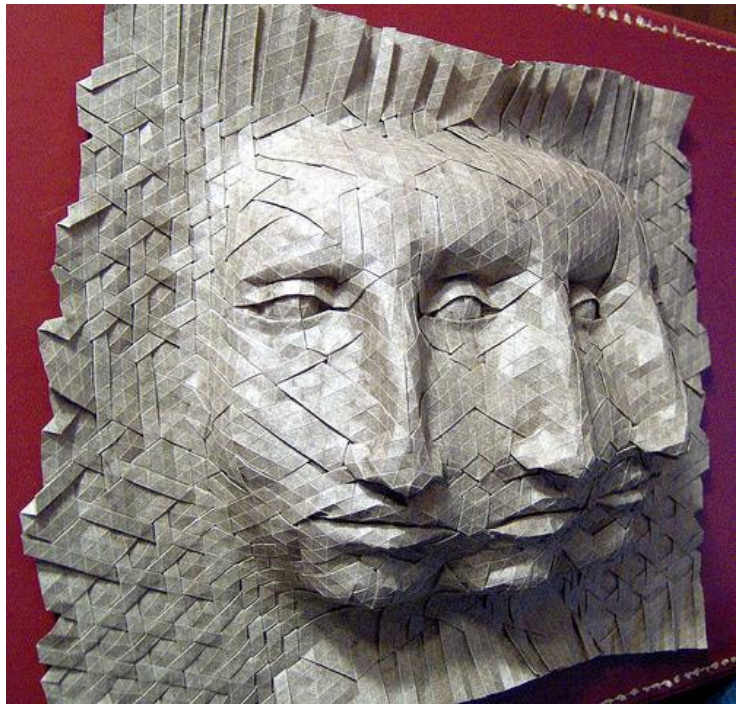
- Complex, Realistic and Elegant – 神谷折紙入門三寶
  Ancient Dragon Bahamut Phoenix

Famous Origamist – Eric Joisel

- Artistic Sculpture

Famous Origamist - Joel Cooper Tessellations Origami

- Different approach to folding a subject



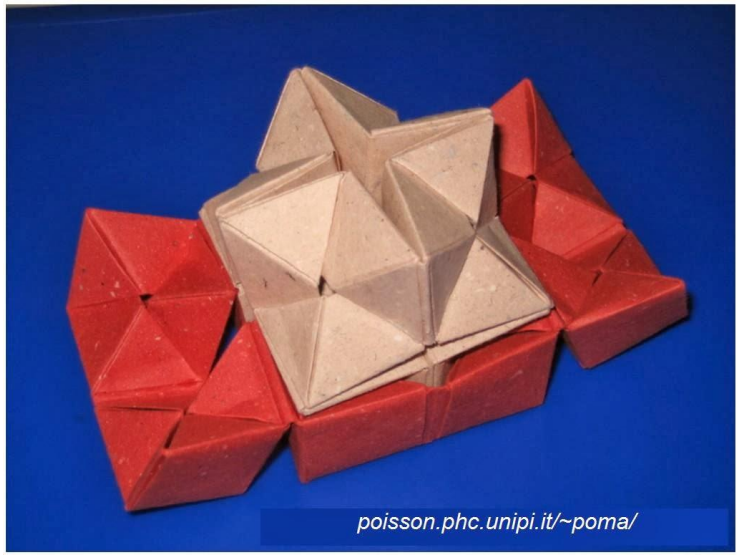
Famous Origamist - **Hideo Komatsu** 小松英夫

- Simple and Practical

Famous Origamist – Hojyo Takashi 北條高史

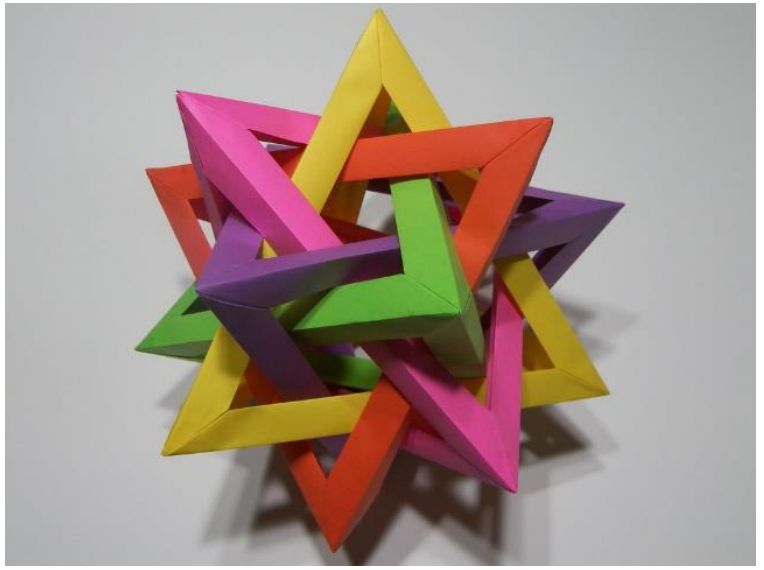
Other Geometric Origami Models

Double star flexicube



Kusudama coral star

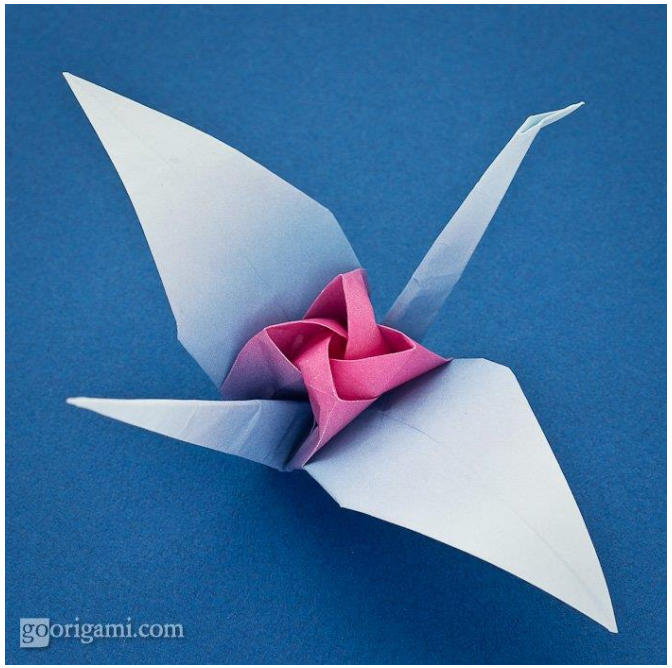
5 intersecting tetrahedra



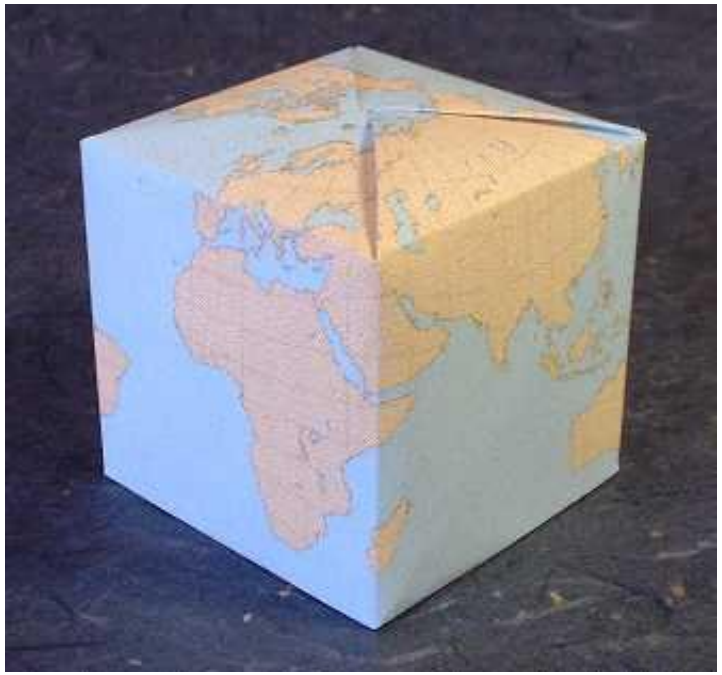
Origami Practices

Dollar Koi Fish

Rose Crane



Fujimoto World Cube



Thank you and have fun!

Origami Resources

- www.origamihouse.jp (Japan Origami Society)
- https://origamiusa.org/ (US Origami Society)
- www.folders.jp (Satoshi Kamiya)
- www.langorigami.com (Robert Lang)
- http://web.mit.edu/chosetec/www/origami/ (Brian Chan)
- http://jasonku.mit.edu/ (Jason Ku)
- https://www.kadechan.com/ (Kade Chan)
- www.origami-shop.com (Premium Origami Paper and Books)
- https://1986688.world.taobao.com/ (心有紙艺 Origami Paper and Tools and Crease Patterns)