Kaleidocycle with Units of Different Lengths

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VIEW IN BROWSER

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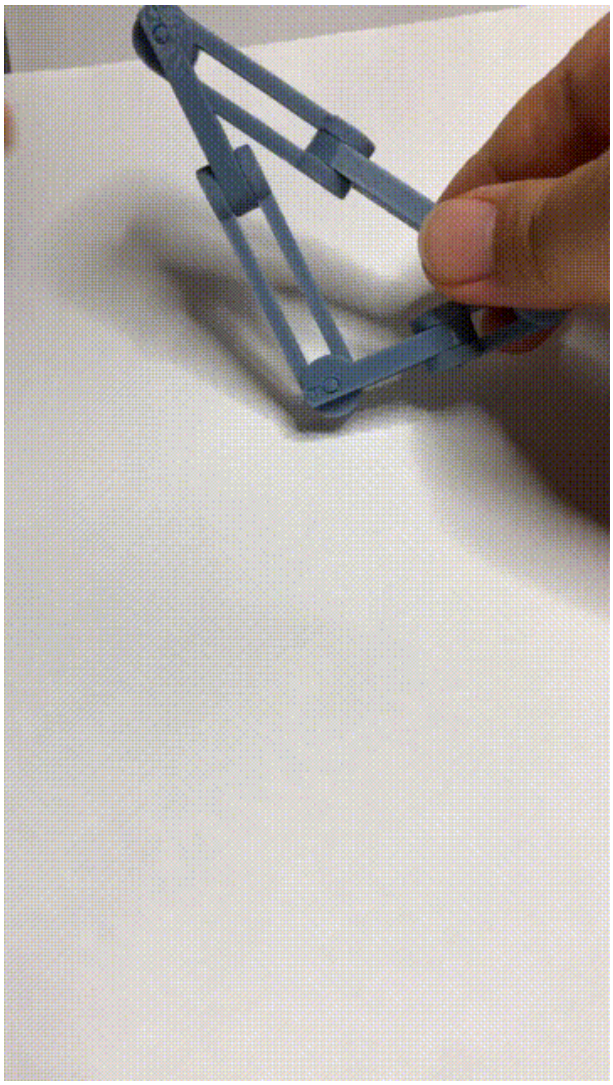
Summary

The unique feature of this kaleidocycle is that each unit has a different length.

Learning > Math

Tags: parametric fusion360 kaleidocycle

The unique feature of this kaleidocycle is that each unit has a different length. A normal kaleidocycle is made by combining six identical units, but this kaleidocycle can be rotated even though the units are of different lengths.



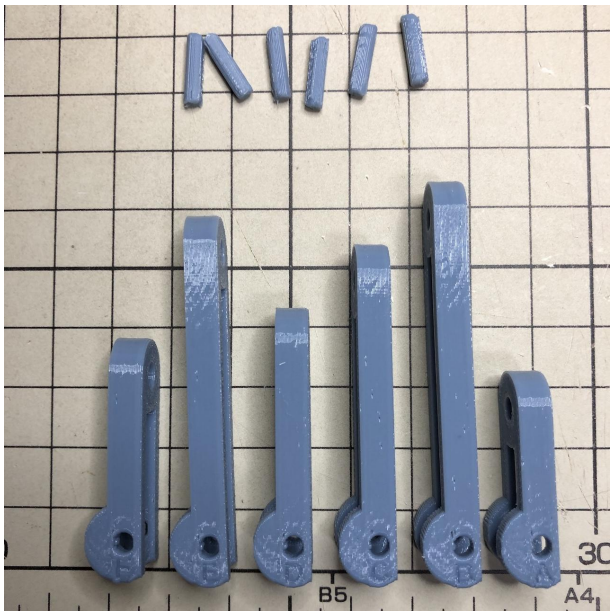
This model was created based on information from the following website.

For the mathematical background, please refer below. It is written in Japanese.

- Top page
  - http://horibe.jp
- Mathematics Probrems Page ... See No.50
  - http://horibe.jp/GrB1F.HTM
  - http://horibe.jp/PDFBOX2019/Triangle-6segment.pdf

How to assemble

- Print Unit A through Unit F one at a time.
  A F



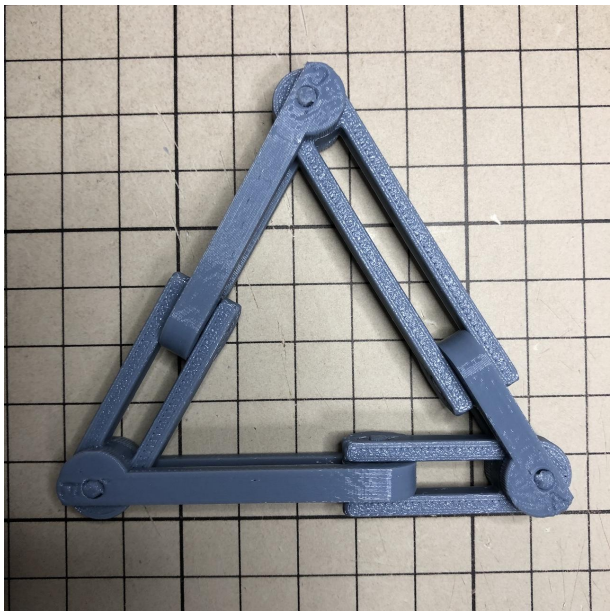
- Prepare 6 M3 bolts 12 mm long or print 6 "pins.step".
  12mm M3 6 pin.step 6
  - If you use pins, you may want to pre-thread a 3mm drill through the small hole in the one with the lettering.
    3mm
    - The pins are small and may require a raft.

  - If you use bolts, they can be self-tapped and screwed in as is, so drilling is not necessary.

    - Be careful not to over-tighten the bolts, as they will not be able to deform.

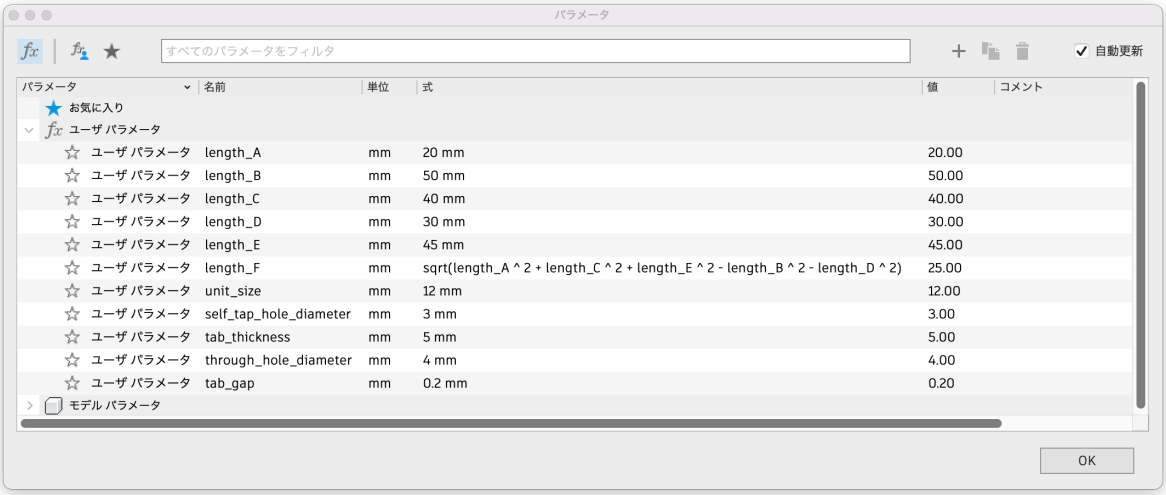
- Connect units A through F in alphabetical order with pins or bolts.
  A F

- Bend the finished product and connect unit A to unit F, and you are done.
  A F



Parameters

If you are able to use Fusion360, you may change the following parameters to make a different shape.
Fusion360



パラメータ

すべてのパラメータをフィルタ　自動更新

パラメータ	名前	単位	式	値	コメント
お気に入り					
ユーザ パラメータ					
ユーザ パラメータ	length_A	mm	20 mm	20.00	
ユーザ パラメータ	length_B	mm	50 mm	50.00	
ユーザ パラメータ	length_C	mm	40 mm	40.00	
ユーザ パラメータ	length_D	mm	30 mm	30.00	
ユーザ パラメータ	length_E	mm	45 mm	45.00	
ユーザ パラメータ	length_F	mm	sqrt(length_A ^ 2 + length_C ^ 2 + length_E ^ 2 - length_B ^ 2 - length_D ^ 2)	25.00	
ユーザ パラメータ	unit_size	mm	12 mm	12.00	
ユーザ パラメータ	self_tap_hole_diameter	mm	3 mm	3.00	
ユーザ パラメータ	tab_thickness	mm	5 mm	5.00	
ユーザ パラメータ	through_hole_diameter	mm	4 mm	4.00	
ユーザ パラメータ	tab_gap	mm	0.2 mm	0.20	
モデル パラメータ					

OK

Update 12/17/2023.
2023/12/17

In the first uploaded version, the first form is an equilateral triangle and the second form is closer to a right triangle.
I tried to make this second form more strictly close to a right triangle. I uploaded the result as "equilateral and right triangle.3mf".
Since it is difficult to formulate and solve the equation, I have found the values by trial and error in a spreadsheet software.

equilateral and right triangle.3mf

- length_A = 20
- length_B = 50 - X
- length_C = 40 - X
- length_D = 30
- length_E = 45 - X/2
- length_F = sqrt(A^2 - B^2 + C^2 - D^2 + E^2)
- X = 1.92925

I also found a parameter that transforms into equilateral and right isosceles triangles. This is uploaded as "equilateral and isosceles right triangle.3mf".

equilateral and isosceles right triangle.3mf

- length_A = 25
- length_B = 45 - X
- length_C = 45 - X
- length_D = 25
- length_E = 35 - X/2
- length_F = sqrt(A^2 - B^2 + C^2 - D^2 + E^2)
- X = 3.981137

Model files

original 7 files

unit-a.step

unit-b.step

unit-c.step

unit-d.step

unit-e.step

unit-f.step

unequal-length-kaleidocycle.f3d

equilateral and right triangle

7 files

unit-a.step

unit-b.step

unit-c.step

unit-d.step

unit-e.step

unit-f.step

equilateral-and-right-triangle.f3d

equilateral and isosceles right triangle 7 files

unit-a.step

unit-b.step

unit-c.step

unit-d.step

unit-e.step

unit-f.step

equilateral-and-isosceles-right-triangle.f3d

unequal-length-kaleidocycle-mk3s.3mf

equilateral-and-right-triangle-mk3s.3mf

equilateral-and-isosceles-right-triangle-mk3s.3mf

pin.step

print 6 pins or use M3x12 bolts

pin6.step

use this if you use raft at printing

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