Printable Programmable Machines Research Update: Fabrication of self-folding printable origami

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Self-folding origami

A

B

C

D
Modeling
Modeling

Angle:

\[
\tan \left( \frac{\theta}{2} \right) = \frac{w_{gap}}{2(t_{paper} + t'_{smp} + \delta)}
\]

Fold Angle Characterization

Fold Angle (degrees)

0 10 20 30 40 50 60 70 80 90

Inner Layer Gap (mm)

0 0.5 1 1.5 2

- data
- model fit
Torque:

\[ T = 2EWt_{smp}(t_{smp}/2 + \delta) \]

Moment due to gravity:

\[ M = \frac{9.8(m_{sub} + m_{smp})L}{2} \]
Automated Generation of Self-Folding Structures

3D Model (Egg) → Simplified model (75 faces) → 2D Unfolding (-5.53° to 58.72°) → CAD Files (.dxf)

Self-Folding Laminate → Folded 3D Object

B. An, S. Miyashita, M. T. Tolley, D. M. Aukes, L. Meeker, E. D. Demaine, M. L. Demaine, R. J. Wood and D. Rus, IROS, accepted.
Egg - suspended
Egg – new design
Egg – new design
Self-Folding in Salt Water

Self-Folding Laminate
Self-Folding in Salt Water: Egg Shape
Self-Folding Miura Pattern

Self-Folding Miura Pattern - Challenges

Self-folding Miura Pattern Attempts
Self-Folding Miura Pattern

15 mm face length
100 faces