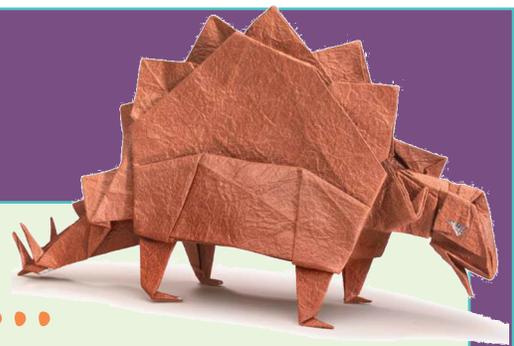# Math Matters

Apply It.

The math behind...
Origami

Technical terms used:

Topology, Folding, Miura-Ori theorem

Uses and applications:

Origami mathematics has been applied to develop foldable space telescopes (at the Lawrence Livermore National Labs1) and Airbags.2 The spiraled sides of some plastic bottles, which make them easy to crush after use, and the solar arrays and antennae on spacecraft3 are diverse applications of Origami math.

How it works:

The common feature used in all these applications is a specific type of folding, referred to as the Miura-Ori fold.4 While studying buckling in cylindrical columns, Dr. Miura Koryo analyzed the crinkles that appeared on the sides. He was able to provide a mathematical proof for the existence of a structure enabling a surface to be folded up into a point. The Miura-Ori technique allows spacecraft antennae to unfold, simply by pulling on opposite diagonal corners. The antennae can be collapsed again by pushing on the opposite diagonal corners. This allows for easier storage and deployment in an application where these are critical.

Interesting facts:

Japanese legends state that anyone who makes a thousand origami cranes will live a long life. In 1955, Sadako Sasaki, a twelve-year-old survivor of Hiroshima, contracted leukemia. While in the hospital, she tried to fold 1,000 cranes but passed away before she could finish. Sadako's statue now stands in Hiroshima's Peace Memorial Park. Origami structural modeling is being applied in diverse fields such as collision safety engineering, interior noise control, and heat shielding. Buildings, car bodies, and furniture are among the objects likely to feature origami-inspired structures as this field develops.

References:

1. https://www.llnl.gov/str/March03/Hyde.html
2. http://www.langorigami.com/science/technology/airbag/airbag.php
3. http://www-g.eng.cam.ac.uk/advancedstructures/
4. Nishiyama, Y., "Miura folding: Applying origami to space exploration", International Journal of Pure and Applied Mathematics, (79) 2012.

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