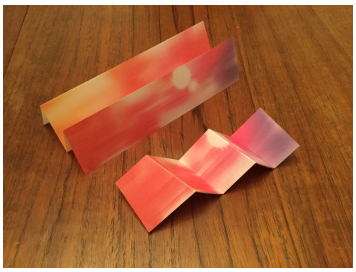
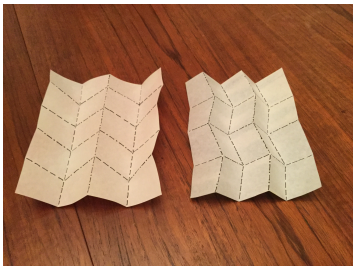
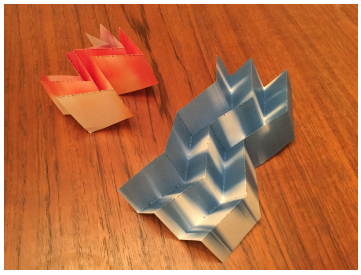
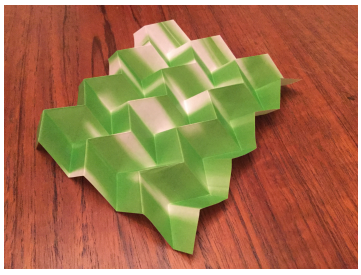
Delta College
Mathematics Division
http://www.delta.edu/math
math@delta.edu

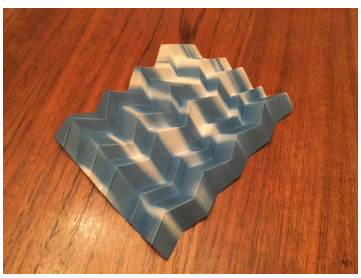
Miura-ori Folding











Koryo Miura was a Japanese physicist who invented a special example of rigid origami that has inspired significant contributions to art, architecture, engineering, and mathematics.

Fold a sheet of paper into four rectangles length-wise, accordion-style, then fold that folded rectangle accordion-style along parallel lines that are neither parallel nor perpendicular to the long thin rectangles.

This creates a tiling of the paper made of parallelograms. The parallelograms are formed by the original three parallel lines you folded, crossed by a set of zig-zag lines. The parallel lines are either mountain folds or valley folds. Each zig-zag line alternates "mountain-valley-mountain-valley".

Gently reverse this state, by making the first zig-zag line entirely a mountain fold, then making the next zig-zag line entirely a valley fold. Finish converting each zig-zag line alternating "entirely mountain", then "entirely valley". The original three parallel lines will be converted to alternating mountain/valley segments.

Now the folded sheet compresses and springs back open along the original parallel lines as if it contains build-in springs! This compression/spring effect is very useful in a multitude of physical applications, from space satellites to load-bearing units in architecture and construction.

Experiment with more parallel lines in the original folds, and more, or differently-spaced zig-zag lines in the cross-folds. Google "Miura-ori images" or "zipper tubes" and be amazed at the two- and three-dimensional applications.

Look at these sites:

http://www.cornell.edu/video/itai-cohen-explains-origami-physics

http://paulino.ce.gatech.edu/pnas_news_zipper.html

You may stumble across the next unexpected and valuable application while you are folding a piece of paper at your kitchen table!

B. David Redman, Jr. *bdredman@delta.edu*