The Mathematical Correlations in an Origami Coiled Structure

Ludgate, Drake (School: Brush High School)
Miner, Nathaniel (School: Brush High School)

Creating a crease in a ring-shaped circular piece of paper results in a saddle-shaped structure which when cut creates a frustum with inner and outer edges in contact with a surface. The purpose of this research is to describe the mathematical relationship between the angle of the peak formed after the circular saddle is cut perpendicular to the crease, the surface area of the ring, the slant height, and the inner and outer radius of the resulting cone (frustum) as the ring is coiled into a loop. Paper rings were created of various size and a circular crease was formed between the inner and outer edge. The resulting saddle-shaped origami structure was then cut and coiled. Measurements of angles, heights, and surface areas were determined. Data was obtained and graphed. Data collected from this research indicates that a curved crease placed on a circular ring will produce a double frustum once the creased ring has been cut. Coiling this double frustum will increase the peak height and decrease the outside angle of the outer frustum as the outer radius is decreased. A double frustum with equal sides, forming an isosceles triangular cross-section, is the optimal design for coiling having the least impact on the total height of the frustum.

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