BOOK REVIEWS

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Origami Tessellations: Awe-Inspiring Geometric Designs
By Eric Gjerde, published by A K Peters Ltd., 2009

Ornamental Origami: Exploring 3D Geometric Designs
By Meenakshi Mukerji, published by A K Peters Ltd., 2009

Combined review by Georg Gunther, Sir Wilfred Grenfell College (MUN), Corner Brook, NL

One of the never-ending appeals of mathematics is the way that simple initial ideas very quickly can lead to unexpected emergent concepts of astonishing complexity. Examples are myriad. Think of the natural numbers, marching on endlessly by increments of one, and giving rise to deep and profound questions that lie at the heart of number theory. Consider the evolution of cellular automata, whose complexities arise out of the simplest kinds of rules describing the birth, death, or survival of the individual cells.

Origami, the traditional Japanese art of paper folding, carries with it the same appeal. The starting components are very simple: a square piece of paper, and a number of simple folding rules. The end results are surprising, beautiful, and unexpected, and appeal to both the mathematician, who senses the underlying geometric regularities, and the non-mathematician, who responds to the artistic and aesthetic dimensions of the finished product. Origami is almost a paradox: rich in form and structure, austere in the purity with which it expresses underlying geometric law. In this, origami reminds one of two other forms of traditional Japanese artistic and intellectual expression: the poetic form of Haiku, and the game of Go.

The two books reviewed here demonstrate again that there is no clear dividing line between mathematics and the visual arts. The study of tessellations is at home as much in the mathematician's den as it is in the artist's studio. Correspondence between the Dutch graphic artist M.C. Escher and the Canadian geometer H.S.M. Coxeter makes it clear that both found inspiration from the other.

The book Origami Tessellations is a wonderful example of how the simple rules of origami can be applied to the mathematics of tessellations to create patterns beautiful enough to grace any wall. In an introductory chapter, the author, the paper-folding artist Eric Gjerde, provides clear and explicit instructions on how to perform the various creases that need to be mastered. The instructions are accompanied by a sequence of diagrams, showing each step and so even the most novice paper folder can learn to master techniques such as the rabbit-ear triangle sink, the rhombus twist,
and the open-back hexagon twist. The rest of the book describes twenty-five origami tessellation projects. These are presented in three groupings. The first ten are beginner projects; this is followed by nine intermediate and six advanced projects. The designs are all beautiful and show a great deal of variation. For example, No. 11, called Château-Chinon, is an octagon-based design, while No. 25, called Arms of Shiva, shows a tessellation of stretched pentagons surrounding a central hexagon.

The second book, Ornamental Origami, is authored by Meenakshi Mukerji, who was awarded the 2005 Florence Temko Award by Origami USA for her contributions to origami. This book develops and presents techniques for constructing 3-dimensional origami designs in which a number of origami modules are assembled in order to construct a complex 3-dimensional shape. Often the shapes created by modular origami are polyhedral, and so it comes as no surprise that many of the shapes presented in this book are based on either the Platonic or the Archimedean solids.

The book is beautifully organized. There is a brief introduction which provides useful folding tips and summarizes some of the basic facts about the underlying geometric solids. Following this, each chapter gives careful instructions for the construction of a number of models based upon a particular basic design feature. Thus, in Chapter 2, the models have a windmill base, while Chapter 3 builds models out of a Blintz base. This is followed by constructions based upon the icosahedron (Chapter 4), sonobe-type units (Chapter 5), floral balls (Chapter 6), finally concluding with a detailed chapter on planar models.

All constructions are clearly described, with detailed sequences of diagrams illustrating each step. Many of the models are stunning in their finished form, regardless of whether this is one of the floral models such as the lush 30-unit assembly of a zinnia, or the more austere star shapes arising out of the planar models.

Both books are lavishly illustrated and even though the two authors are non-mathematicians, these volumes will appeal to mathematicians for providing, in stunning visual form, so many models arising out of strict geometric laws. As for the many who have at one time or another folded paper to construct a boat, an airplane, or a delicate crane, the allure of these books will be hard to resist. They will feel a twitching in their fingers as they reach for a square piece of paper and start to fold, converting geometric regularities into aesthetically pleasing patterns.

Addendum to the November 2009 review of Crocheting Adventures with Hyperbolic Planes by Daina Taimina.

This book has won the coveted Diagram Prize for the Oddest Book Title. Details of the award can be found at http://www.thebookseller.com/blogs/114968-non-euclidian-needlework.html