Designing 3D Structure by 5-7 Kirigami[1] XINGTING GONG, YIGIL
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Pennsylvania — The purpose of this talk is to explore how one can create 3D structures from 2D materials through the art of kirigami. Kirigami expands upon origami
by allowing not only folds, but also cuts, into materials. If we take an incompressible
material such as paper and remove a hole from it, the paper will buckle into the third
dimension once that hole is sealed in order to relieve strain. Thus, orienting cuts
and folds in certain places throughout a sheet of paper can influence its "pop-up,"
3D structure. To narrow down the inverse design problem, we confined ourselves to
making only one kind of cut (which we call the "5-7 cut") on a honeycomb grid, and
we show how this single cut can give rise to arbitrarily complex three dimensional
structures. A simple set of rules exists: (a) one 5-7 cut divides the material into 2
sections which can choose to pop-up or down independently of each other, (b) rows
of uniform cuts must pop up or down in unison, giving (nearly) arbitrary 2D structure, and (c) the 5-7 cuts can be arranged in various ways to create 6 basic pop-up
"modes," which can then be arranged to give (nearly) arbitrary 3D structure. These
simple rules allow a framework for designing targeted 3D structure from an initial
2D sheet of material.

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Date submitted: 11 Nov 2014   Electronic form version 1.4