

Abstract

Kirigami design differs from origami by allowing cuts and material removal in addition to folding. This work explores the use of kirigami as a basis for transforming flat sheets into 3D shapes. By formulating the principles of kirigami with topology and differential geometry, a framework is developed for transforming a sheet between flat and curved configurations by “suturing” cuts in a sheet. This framework is demonstrated by designing and analyzing a kirigami unit cell. We find that this unit cell is a type of plane symmetric 6R linkage. We analyze the linkage and illustrate two possible tessellations. Planar design suitable for standard subtractive machining processes ensures the manufacturability of the structures. We expect this system to find applications in morphing structures and robotics where transitions between curvature states are desired.