

1106-51-2304

Traymon Beavers, Michael Caple, Ezekiel Mihelcic* (mihelcer@dukes.jmu.edu) and **Lisha White**. *Geometric Modeling of Hexagonal Joints*.

Functional wooden pliers can be constructed from a rectangular block of wood using ten cuts, with negligible loss of volume. These cuts form a hexagonal joint, with two reflectional symmetries, around which the pliers can open. A two-dimensional model describing the mechanics of the three-dimensional pliers was constructed based on the lengths of the cuts and the angles at which the cuts are placed. This model fully predicts whether or not pliers constructed with an arbitrary set of cuts can open and, if so, how far those pliers will open, based solely on the parametrization of the hexagonal joint by a characteristic length, λ , and an angle, θ . Additionally, techniques from linear algebra and analysis are utilized to determine the set of possible pivot points and to derive a closed form solution for the maximum angle of opening, given an arbitrary pivot point. (Received September 16, 2014)