

A Hooke's Joint Flexagon

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A Hooke's joint, as used in motor vehicle drivelines, is shown schematically in Figure 1 in a form that can be used to construct a paper model. The two strips are hinged to the central square so the Hooke's joint has two degrees of freedom, but these differ from those of point hinges. Hence, the dynamic properties of Hooke's joint flexagons differ significantly from those of point flexagons.

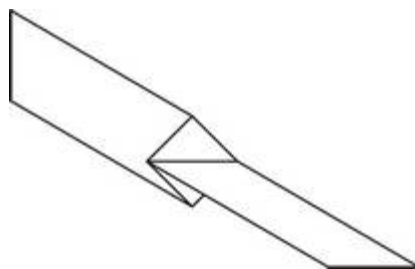


Figure 1. Paper model of a Hooke's joint.

The net for a truncated square Hooke's joint flexagon is shown in Figure 2. This is the same as one of the hybrid flexahedrons described by D. Engel (Hybrid flexahedrons. *Journal of Recreational Mathematics*. Jan 1969, **2**(1), 35-41) except that the leaves are a different shape. The squares have been truncated to irregular hexagons in order to accommodate the Hooke's joints. To assemble the flexagon, first transfer the numbers in brackets on the upper face of a leaf to the same positions on the lower face, and delete them from the upper face. Then overlap the leaves, as shown in Figure 3, and insert the small squares as shown. Tape over the four diagonals to form hinges between the leaves and small squares. Turn the flexagon over, keeping everything in position, and tape the remaining four diagonals.

As assembled the flexagon is in position 1, as shown by the numbers at the centre of the flexagon. To reach position 2 rotate the leaf numbered 1 and 2 through 180° about the two Hooke's joints connecting it to adjacent leaves. This *simple flex* is similar to that used for point flexagons, but not identical. A cycle of 8 different positions, with face numbers appearing in cyclic order at the centre of the flexagon, can be traversed by repeating the flex.

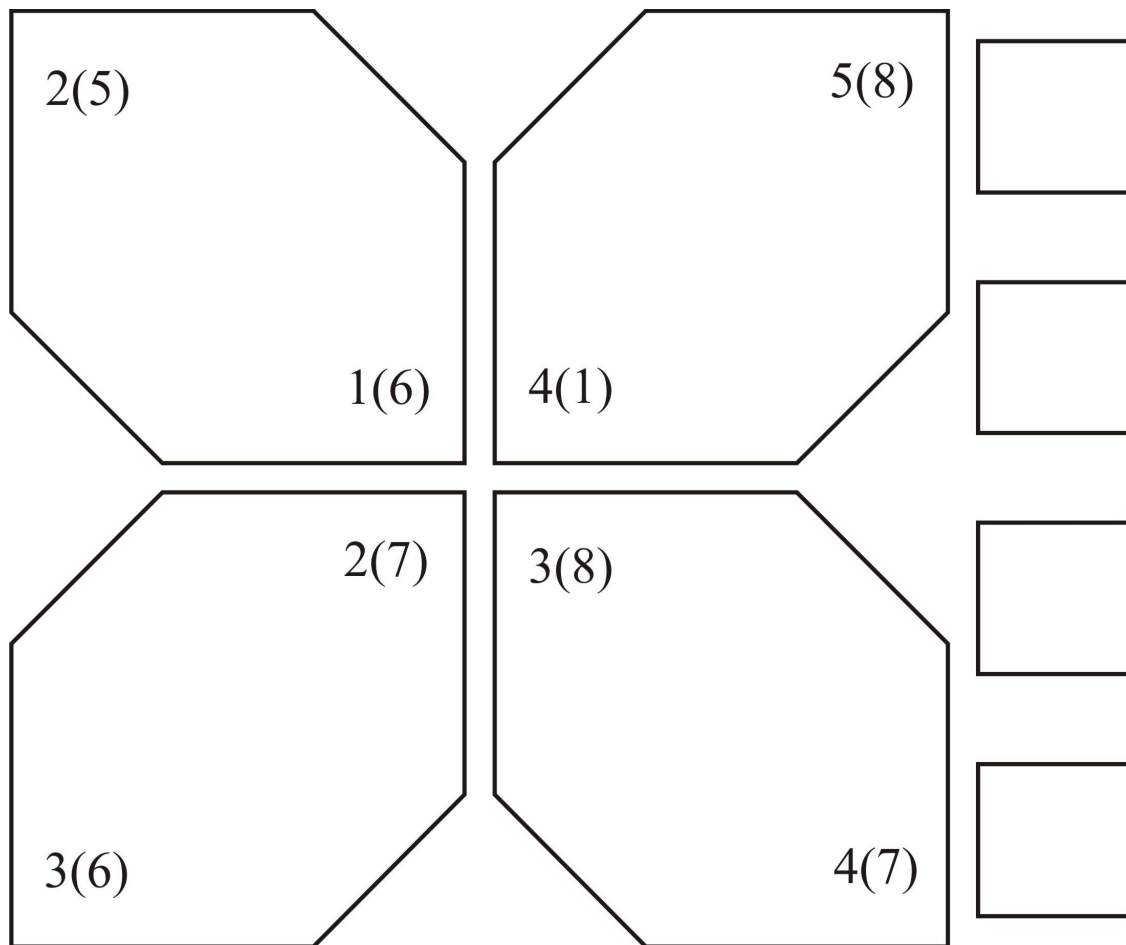


Figure 2. Net for a truncated square Hooke's joint flexagon. One copy needed.

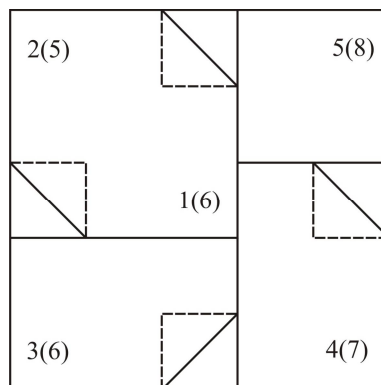


Figure 3. Assembly of a truncated square Hooke's joint flexagon.