

## U-Joint Phasing

When a u-joint is operated through an angle, the output of the u-joint accelerates and decelerates when compared to the input. The u-joint cycles through this pattern every  $180^\circ$ , or twice per revolution (as seen in Figure 1). By phasing two joints so that their cycles are  $90^\circ$  apart, the accelerations of the first u-joint will be canceled by the accelerations of the second, resulting in a linear output (as seen in Figure 2).

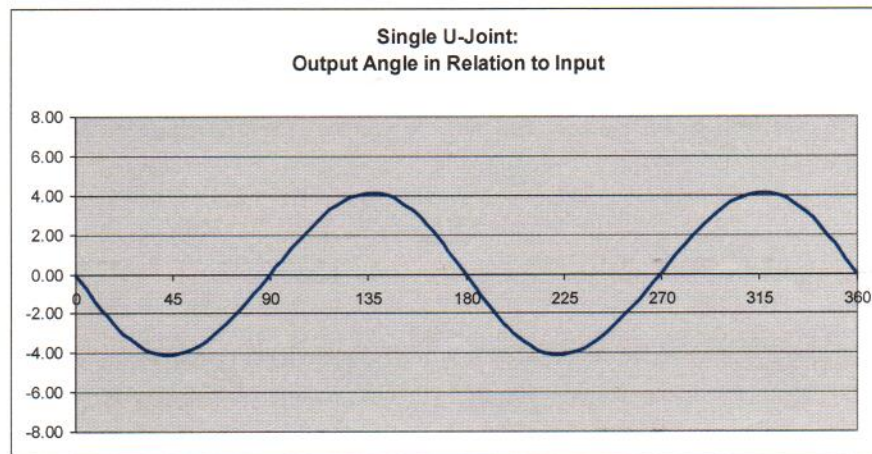


Figure 1: Single U-Joint

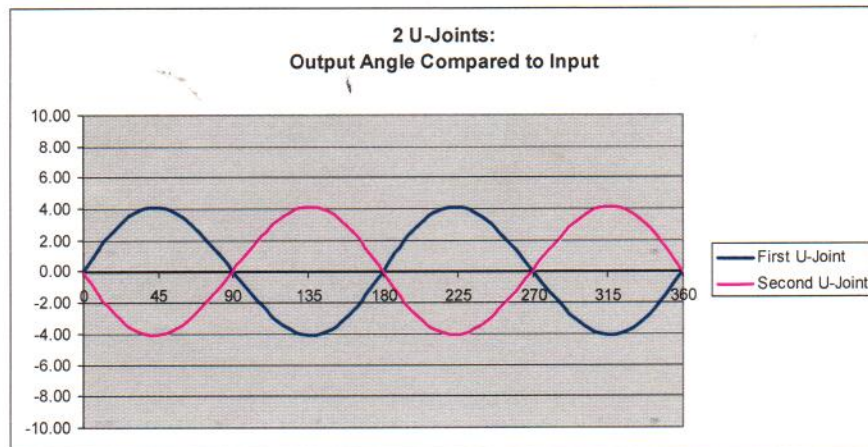


Figure 2: Pair of U-Joints

As a general rule, pairs of u-joints should be phased so that the inner pair of yokes is in line with each other. This, however, only works when all of the joints and shafts lie on a single plane, as with a driveshaft. In a steering column, each u-joint often lies in a separate plane from any other u-joint, and this must be accounted for. In these cases the inner yokes of a pair of u-joints must be set to lie on their own plane, rather than directly in line with each other.

In 3 u-joint systems, it is possible to phase both of the two lowest angle u-joints to the higher angle joint in order to cancel its accelerations. Alternatively a double u-joint may be used in place of the highest angle joint, with the two lower angle joints used to cancel each others accelerations. In 4 u-joint systems it is best to phase the highest angle u-joints as a pair, and the lowest angle u-joints as a pair.

To verify the u-joints in a system are phased properly, degree wheels can be attached at the steering wheel and just before the rack, and the output checked versus the input.