Double-Cardan and Cardan Joint

Lesson Plan





**Goals/Objectives**

* Notice that a Double-Cardan Joint transmits a constant input shaft speed as a constant output shaft speed
* Notice that a Cardan Joint has a varying output speed based on a constant input speed – this becomes more evident as the misalignment angle increases
* Notice that as the misalignment angle increases, the joints begin to bind

**Background**

Both Cardan and Double-Cardan Joints are used to transmit angular motion through misalignment angles. A Cardan Joint will not transmit a constant input speed as a constant output speed through the misalignment angle leading to vibrations. A graph of the output velocities of a Cardan Joint based on an input angular velocity of 1 unit can be seen in Figure 1 where θ is the misalignment angle.

A Double-Cardan Joint has two Cardan Joints phased apart from one another which works to cancel out these variations leading to a steady output speed and no vibrations.

**Instructor Prep**

Follow the Instructables instructions to print and assemble the device.

Familiarize yourself with the concepts demonstrated by the device.

**Class Activities**

Show videos from the Instructables site to show the difference in output speeds of the two shafts.

Discuss why the Cardan Joint creates a varying output speed and how the Double-Cardan Joint cancels out these variations.

Pass around the 3D printed mechanism to allow the students to see the concepts at work.

**After Class Activities**

Have students research the most common uses of these joints.

Have students determine situations where a Cardan Joint is acceptable even though it can cause vibrations and does not perfectly transmit the input speed.

**Additional Materials:**

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Figure 1 - Cardan Joint Output Speeds based on an Input Speed of 1 Unit