

Elementary Dynamics

Introduction to Rigid Body Kinematics in Two Dimensions

Rigid Body Motion

The diagram illustrates a rigid body B in two dimensions acted on by a set of forces \mathbf{F}_i ($i = 1, \dots, N$). There are **three** basic types of motion that B can undergo – ***pure translation***, ***pure rotation***, and ***general plane motion***.

To illustrate this point further, consider the **two mechanisms** illustrated at the right. Note for both systems the bars connected to the ground exhibit ***pure rotational motion***. However, the connecting bars of the two systems undergo different types of motion. The connecting bar of the top mechanism exhibits ***pure translational motion*** while the connecting bar of the bottom mechanism exhibits ***general plane motion*** (it translates and rotates).

Pure Translational Motion

When a body undergoes ***translational motion***, all points in the body have the ***same velocity*** and ***acceleration***. If all the points are all moving in a ***straight line***, the motion is called ***rectilinear translation***. If all the points are moving along ***curved paths***, the motion is called ***curvilinear translation***.

Pure Rotational Motion (Rotation about a Fixed Axis)

A body has ***pure rotational motion*** when one of its points is fixed, and all its other points rotate about it. The body is rotating about an axis that passes through the fixed point and is perpendicular to the plane of motion. In this case, all the points of the body have ***circular motion***.

General Plane Motion

General plane motion combines translational and rotational motion. Generally, ***all points*** of the body have ***different velocities and accelerations***, and no point on the body is fixed.

