

Physical objects in dynamics and object-oriented programming

<i>Point</i>	Dimensionless object having a location in space.
<i>Particle</i>	Point with mass.
<i>Vector basis</i>	Set of vectors that span space.
<i>Rigid vector basis</i>	Vector basis whose bases vectors have constant magnitude and whose angles between bases vectors remain constant.
<i>3D orthogonal unitary right-handed vector basis</i>	Rigid vector basis with 3 orthogonal unit vectors having an intrinsic order. Given bases vectors $\hat{\mathbf{a}}_1, \hat{\mathbf{a}}_2, \hat{\mathbf{a}}_3$, right-handed requires $\hat{\mathbf{a}}_1 \times \hat{\mathbf{a}}_2 \cdot \hat{\mathbf{a}}_3 > 0$.
<i>Rigid frame</i>	Rigid vector basis with an associated point (“origin”). A rigid frame implies a unique reference frame. An infinite number of rigid frames can be fixed in a reference frame.
<i>Reference frame</i>	Rigid object which can be regarded as extending infinitely in all spatial dimensions – on which can be fixed an infinite number of points, rigid bases, or rigid frames. Reference frames are useful for measuring translational motions of points (velocity or acceleration) and measuring rotational motions of rigid bases, rigid frames, or rigid bodies (angular velocity/acceleration)
<i>Rigid body</i>	Reference frame with mass and inertia.

Mathematical objects in dynamics

<i>Coordinate</i>	Scalar quantity that helps locate points or orient objects (e.g., distances or angles).
<i>Coordinate system</i>	Set of coordinates.
<i>Generalized coordinate</i>	Coordinate that is used to form one of Lagrange’s equations of motion.
<i>Generalized speed</i>	Linear combination of time-derivatives of generalized coordinates that is used to form one of Kane’s equations of motion.
<i>Rotation matrix</i>	Matrix that relates orientation of two orthogonal unitary vector bases.
<i>Angular velocity</i>	Vector that relates time-rate of change of orientation of two rigid bases (or rigid frames or reference frames or rigid bodies).
<i>Angular acceleration</i>	Vector that relates time-rate of change of angular velocity of two rigid bases (or rigid frames or reference frames or rigid bodies).
<i>Position vector</i>	Vector that relates the location of two points.
<i>Velocity</i>	Vector that describes the time-rate of change of a point’s location in a reference frame.
<i>Acceleration</i>	Vector that describes the time-rate of change of a point’s velocity in a reference frame.
<i>Transformation matrix</i>	Matrix that relates orientation and position of two rigid frames.
<i>Spatial velocity</i>	Matrix that relates angular velocity and velocity of two rigid frames.
<i>Spatial acceleration</i>	Matrix that relates angular acceleration and acceleration of two rigid frames.