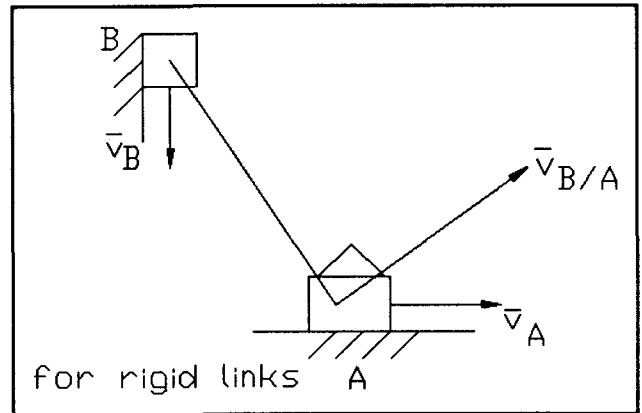


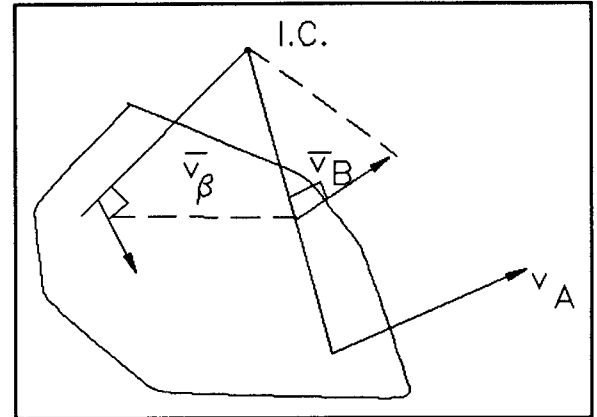
SUMMARY DYNAMICS MODULE N7

SUBJECT	EQUATION	DISCUSSION
Translation	$\vec{r}_B = \vec{r}_A + \vec{r}_{B/A}$ $\vec{v}_B = \vec{v}_A$ $\vec{a}_B = \vec{a}_A$	For a rigid body in pure translation all points have the same velocity and acceleration.
Rotation about a fixed axis	$\vec{v} = \vec{\omega} \times \vec{r}$ $\vec{a} = \vec{\alpha} \times \vec{r} + \vec{\omega} \times (\vec{\omega} \times \vec{r})$ if $\alpha = \text{const.}$ $\omega = \omega_0 + \alpha t$ $\theta = \theta_0 + \omega_0 t + \frac{1}{2} \alpha t^2$ $\omega^2 = \omega_0^2 + 2 \alpha (\theta - \theta_0)$	All velocities and accelerations used must be rad/time.
General Plane Motion	$\vec{v}_B = \vec{v}_A + \vec{v}_{B/A}$ $= \vec{v}_A + \omega \vec{k} \times \vec{r}_{B/A}$	General plane motion may be considered as the sum of rotation plus translation.



Instant Center

In general plane motion, at any instant a body rotates about some point in space. All velocities on the body are perpendicular to radial lines from the I.C. to points on the body.



Velocity on any point on the body is proportional to the distance from the I. C., the constant of proportionality being the angular velocity.

Acceleration
for Plane Motion

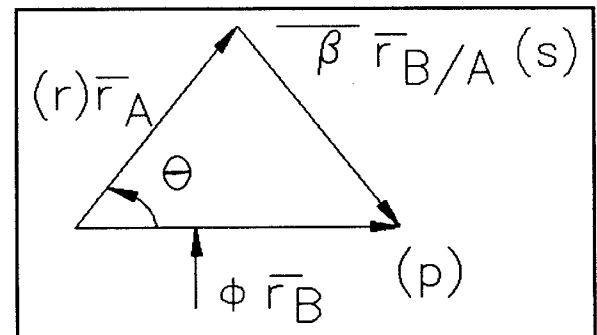
$$\bar{a}_B = \bar{a}_A + \bar{a}_{B/A}$$

For a rigid link

$$\bar{a}_{B/A} = \alpha \bar{k} \times \bar{r}_{B/A} - \omega^2 \bar{r}_{B/A}$$

For an extensible link

$$\bar{r}_B = \bar{r}_A + \bar{r}_{B/A}$$



$$p\bar{u}_p = r\bar{u}_r + s\bar{u}_s$$

$$\underbrace{\frac{dp}{dt}\bar{u}_p + p\frac{d\phi}{dt}\bar{u}_\phi}_{\bar{v}_B} = \underbrace{\frac{dr}{dt}\bar{u}_r + r\frac{d\theta}{dt}}_{\bar{v}_A} +$$

$$\underbrace{\frac{ds}{dt}\bar{u}_s + \frac{d\beta}{dt}\bar{u}_\beta}_{\bar{v}_{B/A}}$$

$$\underbrace{\left[\frac{d^2p}{dt^2} - p\left(\frac{d\phi}{dt}\right)^2 \right]\bar{u}_p + \left[2\frac{dp}{dt}\frac{d\phi}{dt} + p\frac{d^2\phi}{dt^2} \right]\bar{u}_\phi}_{\bar{a}_B} =$$

$$\underbrace{\left[\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2 \right]\bar{u}_r + \left[2\frac{dr}{dt}\frac{d\theta}{dt} + r\frac{d^2\theta}{dt^2} \right]\bar{u}_\theta}_{\bar{a}_A} +$$

$$\underbrace{\left[\frac{d^2s}{dt^2} - s\left(\frac{d\beta}{dt}\right)^2 \right]\bar{u}_s + \left[2\frac{ds}{dt}\frac{d\beta}{dt} + s\frac{d^2\beta}{dt^2} \right]\bar{u}_\beta}_{\bar{a}_{B/A}}$$

WORDS TO KNOW MAJOR MODULE 7

1. Linkage - a truss that moves.
2. On a rear-wheel drive vehicle, there is no traction on the front wheels.
3. Translation - motion in which any straight line inside the body keeps the same direction during the motion of the body. Also, points on the body have the same velocity at any instant in time.
4. Rectilinear Translation - this is where the translation motion (see above definition for translation) paths are in a straight line.
5. Curvilinear Translation - when the translation motion paths are in curved lines.
6. General Plane Motion - considered the sum of the translation and rotation motions.
7. Centroidal Rotation - rotates about CG but does not translate.
8. Instant Center of Velocity - concerns general plane motion, where the Instant Center is a point where the velocity of the body is zero.
9. Radius of Gyration (K) - that in a revolving body in which its angular momentum is concentrated. $K = \sqrt{I/M}$ where M is mass and I is the moment of inertia about the center of gravity.
10. Connecting Rod - connects the piston (slider) to the crank.
11. Crank - an arm attached to a shaft carrying at its outer end a pin parallel to the shaft.
12. Engine Speed - the speed, in revolutions per minute, of the driving shaft of an engine.
13. Gear - any mechanical system for transmitting motion.
14. Pinion - a small toothed wheel.
15. Rack and Pinion - an arrangement of a straight-toothed rack and a pinion used to convert rotary motion into linear motion.
16. Rack - a straight length of toothed gearing.
17. Slider - a piece of mechanism which moves in a linear direction over a flat or curved face between guides.