Performance e.g. 5k faster

Rehab

movements ← Functional Anatomical

Displacement in time ⇒ Kinematics

Linear

① Position

- Displacement
  $\Delta s = s_f - s_i$
  units: length
- Distance

② Velocity. $v = \frac{\Delta s}{\Delta t}$

units $\frac{\text{length}}{\text{time}}$

Speed $= \frac{\text{Distance}}{\text{time}}$

③ Acceleration $a = \frac{\Delta v}{\Delta t}$

units $= \frac{\text{vel}}{\text{time}}$

Angular

Angular Position

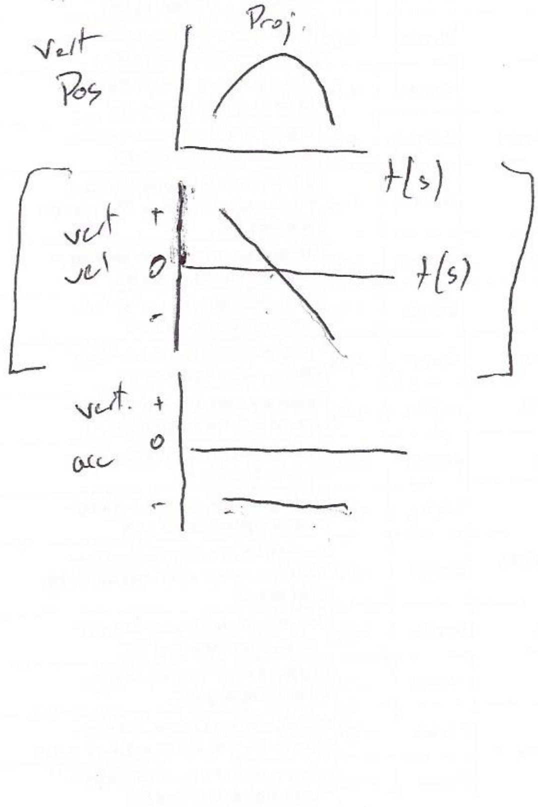
- Ang. Displacement
  $\Delta\theta = \theta_f - \theta_i$
  units: deg, rad, rev
- Ang Distance

Relative (Joint) Absolute (segment)

Angular Velocity $\omega = \frac{\Delta\theta}{\Delta t}$

Angular Speed $\frac{\text{Angdist}}{\text{time}}$

Ang. Acc. $\alpha = \frac{\Delta\omega}{\Delta t}$



Types of Motion

- Linear
- Angular
- General

1

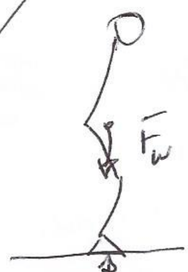
Forces $\Rightarrow$ Kinetics

Newton's Laws

1. Uniform
2. Acceleration $\sum F_{on} = ma_{com}$
3. Action - Reaction

"ON" - "BY"

external
- Gravity
- GRF
- Drag
- Friction
- Buoyancy



F_{GRF}
- F_x = Medial-Lateral
- F_y = Anterior-Posterior
- F_z = Vertical

Kinetic

1. Identify forces acting on object.
2. $\sum F = ma$
3. Analyze on dimension at a time

$\sum F = ma = m\frac{\Delta v}{\Delta t}$

$\sum F_z = ma_{com_z}$

muscle

$\underline{\sum F \Delta t} = \Delta(mv)$

Impulse — momentum

Ft = mv

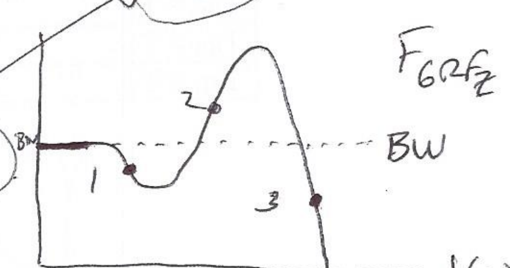
$N \cdot s$ = $\frac{kg\,m}{s}$

$\frac{kg\,m}{s^2} \cdot s = \frac{kg\,m}{s}$

$F_{GRF_z} + (-F_w) = ma_{com_z}$

$F_{GRF_z} = ma_{com_z} + F_w$

F_{GRF_z}



e.g. 1 if BW = 1000N
GRF_z = 900N
a = −

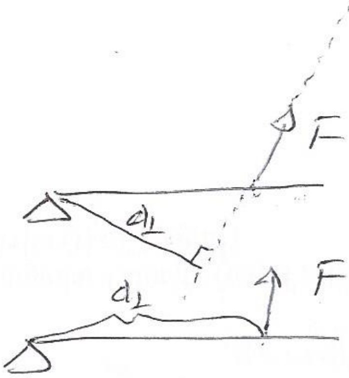
eg 2 if BW = 1000N
GRF_z : 1100N
a = +

3 $\Rightarrow$ a = −

Angular Kinetics

Torque

$$T = F d_{\perp}$$



units : Nm

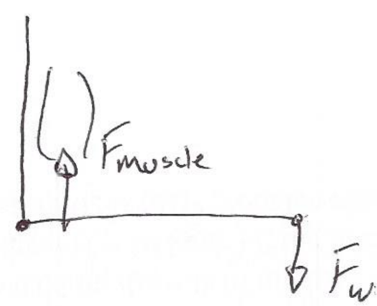
$$\Sigma T = I \alpha$$ ← Angular acceleration units : rad/s²

moment of inertia : resistance to change angular motion

$I = \Sigma m r^2$ ⇐ how mass is distributed about axis of rotation.

units : $kg m^2$

$$I\alpha = kg\, m^2 \frac{\cancel{rad}}{s^2} = \frac{kg\, m^2}{s^2} = \underbrace{\left(\frac{kg\, m}{s^2}\right) m}_{N\, m}$$



$\omega_i = 0$ °/s ie no movt & wt is handed

$\omega_f = ?$

does it become +, −, remain 0 °/s ?

e.g. if $F_m = F_w \Rightarrow$ eccentric

$+ \; T_{muscle} = F_{mus.} \; d_{\perp mus}$ CCW +

$- \; T_{wt} = F_{wt} \; d_{\perp wt}$

$$\Sigma T = I \alpha$$

$$T_{ms} + (-T_w) = I\alpha = I \frac{\omega_f - \omega_i}{\Delta t}$$

e.g. if $T_M = T_w \Rightarrow$ Isometric

$T_M > T_w \Rightarrow$ Concentric

$T_M < T_w \Rightarrow$ Eccentric

CNS Brain
Reflexs

environment : Any external to the person
- weather
- Psychological

Kinematics

	units	
Distance	length : m, ft, yd, mi...	$\Delta s = s_f - s_i$
Displacement	length : m, ft...	$v = \frac{\Delta s}{\Delta t}$
velocity	$\frac{\text{length}}{\text{time}}$ $\frac{m}{s}$ $\frac{mi}{hr}$	
speed	$\frac{\text{length}}{\text{time}}$	$\frac{\text{distance}}{\text{time}}$
Acceleration	$\frac{\text{vel}}{\text{time}}$ $\frac{m/s}{s}$ $\frac{m}{s^2}$ $\frac{mph}{s}$	$a = \frac{\Delta v}{\Delta t}$
Ang. Displacement	rad, deg, rev	$\Delta\theta = \theta_f - \theta_i$
Ang Distance	rad, deg, rev	
Relative :		
Absolute	eg °/s rad/s rev/min ...	$\omega = \frac{\Delta\theta}{\Delta t}$
Angular velocity	eg. °/s rad/s rev/min ...	
Angular speed		$\alpha = \frac{\Delta\omega}{\Delta t}$
Angular Acceleration	eg. $\frac{°/s}{s}$ °/s^2 rad/s^2	
Force	N $\frac{kgm}{s^2}$	$\Sigma F = ma$
Inertia	kg	mass
Impulse	Ns	$F\Delta t$
momentum	$\frac{kgm}{s}$	mv
Ang Impulse	Nm s	$T\Delta t$
Ang momentum	$\frac{kgm^2}{s}$	$I\omega$
Torque (moment)	Nm	$T = Fd_\perp$
		$\Sigma T = I\alpha$
moment of inertia	kgm^2	$I = \Sigma mr^2$
Newton's laws of motion		1. uniform 2. Acc. 3. Action-Reaction
F_{DRAG}	N	$F_{DRAG} = \frac{1}{2}\rho C_D A v^2$
Air Resistance		
Water		
Work	Joules	Fd
Power	watts	$\frac{W}{t} = \frac{Fd}{t} = Fv$