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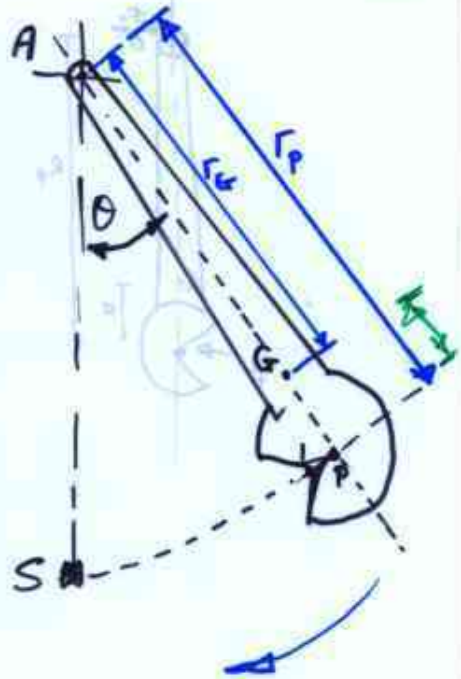
CHARPY IMPACT TESTER

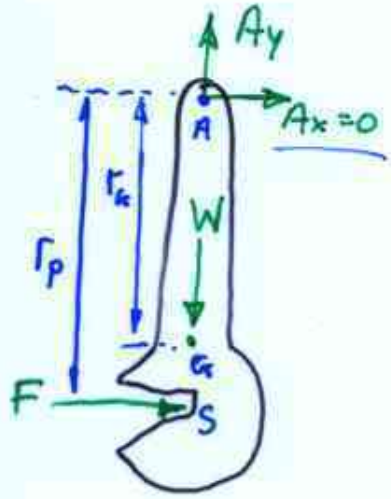


PENDULUM SWINGS & STRIKES TARGET AT S.

find r_p to minimise Horiz force at A during impact

Simplify calc. by assuming specimen stops the PENDULUM.

FREE BODY DIAGRAM at moment of impact



ang vel just before impact is ω_1 c.w.

v_{G_1} is $r_G \omega_1$, to left ←

after impact $v_{G_2} = 0$ & $\omega_2 = 0$

⇒ angular momentum EQN

$\boxed{\circlearrowleft +}$ $I_A \omega_1 - \left(\int F\,dt\right) r_p = 0$ $\quad \cancel{I_A \omega_2} \to 0$

linear momentum

$\overset{+}{\rightarrow}$ $-m(\overset{v_{G_1}}{r_G \omega_1}) + \left(\int F\,dt\right) = 0$ $\quad$ [note $A_x = 0$]

SOLVE BETWEEN 2 EQNS, Eliminating $\int F\,dt$:

$$I_A \cancel{\omega_1} - m r_G \cancel{\omega_1} r_p = 0$$

note $I_A = m k_G^2 + m r_G^2$

radius of gyration

$I_A = m k_A^2$

$$\Rightarrow r_p = r_G + \frac{k_G^2}{r_G}$$

$$r_p = \frac{r_G^2 + k_G^2}{r_G} = \frac{k_A^2}{r_G}$$ } centre of percussion