

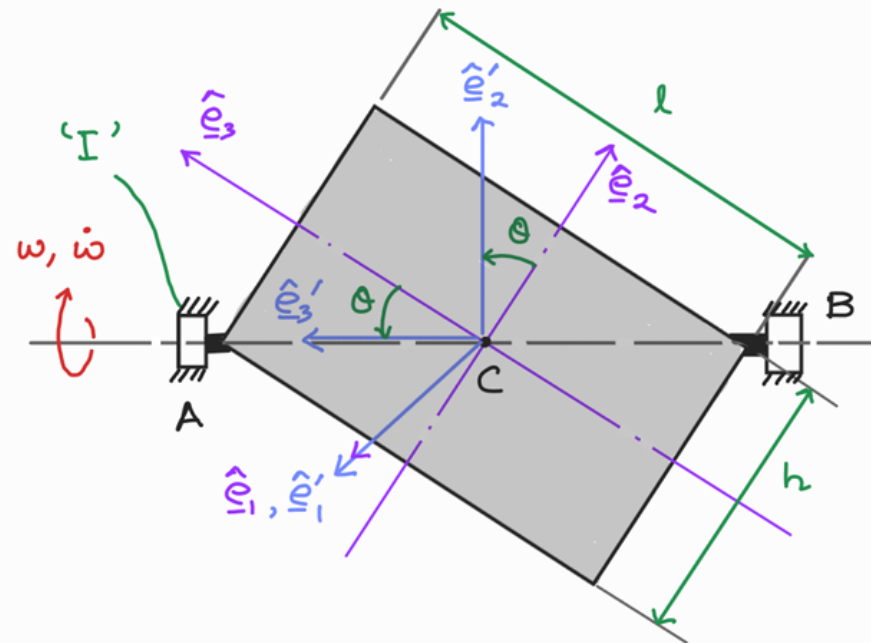
## Tutorial 6 (Part A)

A thin homogeneous rectangular plate, as shown, rotates about a diagonal axis with angular velocity  $\underline{\omega}$  and angular acceleration  $\underline{\dot{\omega}}$ .

- (i) Determine the total moment  $\underline{M}_C$  exerted on the plate about the COM  $C$ , using the coordinate system  $\hat{e}'_1, \hat{e}'_2, \hat{e}'_3$  in terms of the rotational motion  $\underline{\omega}$  and  $\underline{\dot{\omega}}$ .
- (ii) Find the relation between a drive torque  $\underline{T} = T\hat{e}'_3$  (applied about  $\hat{e}'_3$ -axis) to the rotational motion. Also, determine the bearing support reaction forces (assuming bearing support reaction couples are zero).

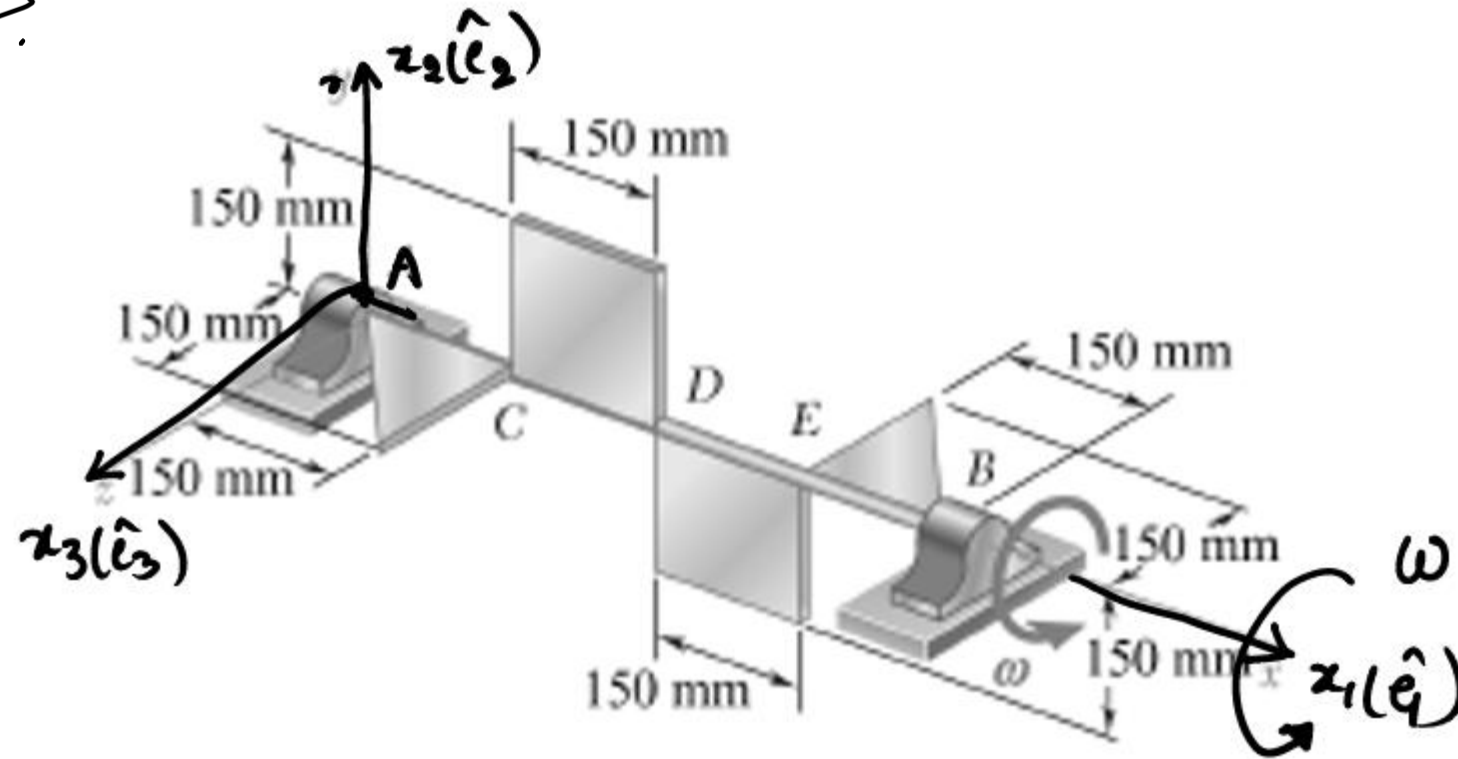
Given:  $\underline{\omega}_{m|I} = \omega \hat{e}'_3$   
 $\underline{\dot{\omega}}_{m|I} = \dot{\omega} \hat{e}'_3$

plate lies in the plane of  
 $x_2(\hat{e}_2) - x_3(\hat{e}_3) / x'_2(\hat{e}'_2) - x'_3(\hat{e}'_3)$   
 Both CSs are body-fixed.



Q1. Relate the reaction forces and moments of couples at A and B to the motion of the shaft. Angular velocity of the shaft is constant.

Set 6 B



Answer:  $A_1 + B_1 = 0$ ,  $A_2 + B_2 = mg$ ,  $A_3 + B_3 = 0$

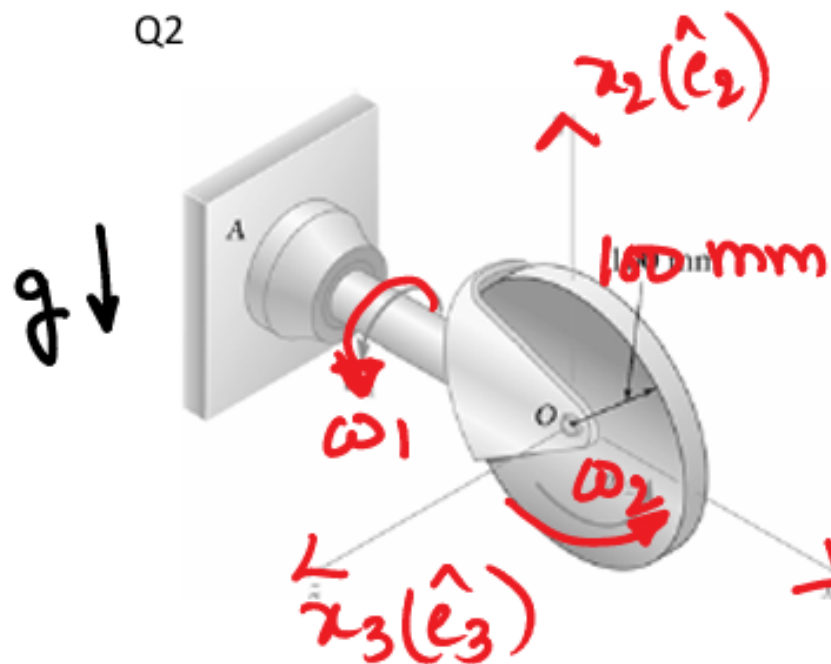
$$0.3A_3 - 0.3B_3 + C_{A2} + C_{B2} = -I_{31}^D \omega^2$$

$$-0.3A_2 + 0.3B_2 + C_{A3} + C_{B3} = I_{21}^D \omega^2$$

Set 6 B: Q 2

(Type II: problem)

Q2



### PROBLEM 18.83 (Beer Johnston)

The uniform thin 2.5-kg disk spins at a constant rate  $\omega_2 = 6 \text{ rad/s}$  about an axis held by a housing attached to a horizontal rod that rotates at the constant rate  $\omega_1 = 3 \text{ rad/s}$ . ~~Determine the couple which represents the dynamic reaction at the support A.~~

**Find the force and moment of couple acting on the rod at A. (at this instant).**  
 (Ao is massless)

$AO = 1\text{m}$

$$\underline{F} = 24.5 \text{ N vertically up}$$

$$\underline{C} = -0.225 \text{ Nm } \hat{e}_2 + 24.5 \text{ Nm } \hat{e}_3$$

$\hat{x}_1(\hat{e}_1) \hat{x}_2(\hat{e}_2) \hat{x}_3(\hat{e}_3)$  is fixed to the disk.