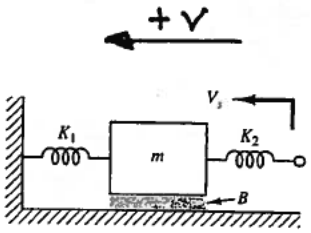
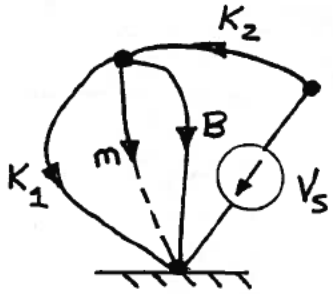
CHAPTER 4

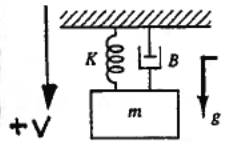
PROBLEM 4.1

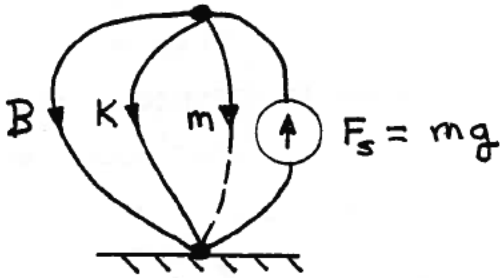
(a)



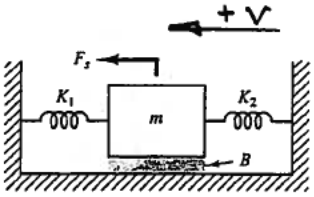


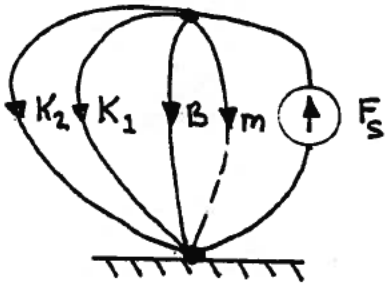
(b)



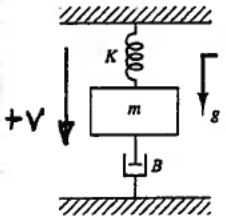


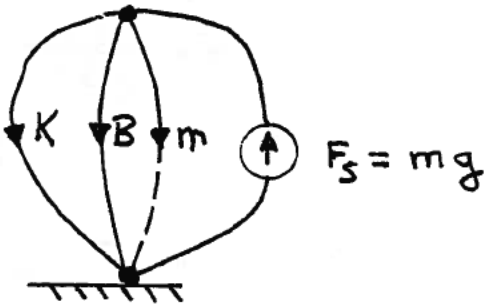
(c)





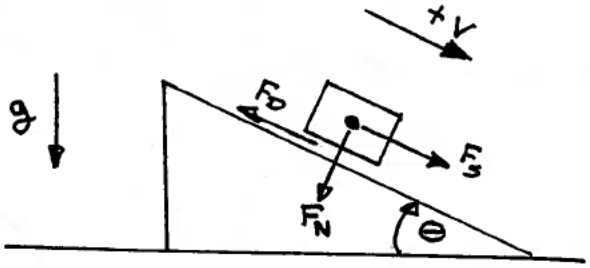
(d)





PROBLEM 4.2

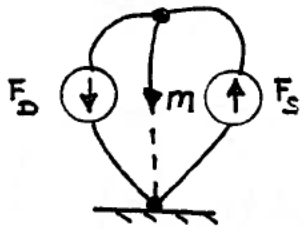
(a)



$$F_S = mg \sin\theta$$
$$F_N = mg \cos\theta$$

GRAVITY PROVIDES a force F_S along the plane AND F_N NORMAL to it acting ON the MASS. THE DAMPER FORCE F_D IS DUE TO the friction MATERIAL AND OPPOSES the MASS MOTION

(b)



(c) AS θ INCREASES THE force F_S INCREASES. AS friction INCREASES the force F_D INCREASES

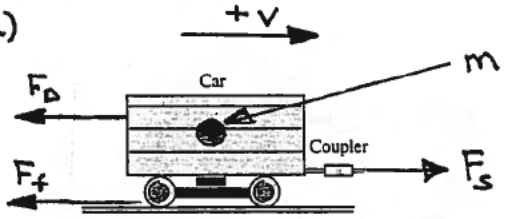
(d) For linear friction $F_D = BV$
AT terminal velocity V_T = constant
$\therefore \frac{dV}{dt} = 0$ AND $F_D = F_S$

$$BV_T = mg \sin\theta$$

$$V_T = \frac{mg}{B} \sin\theta$$

PROBLEM 4.3

(a)

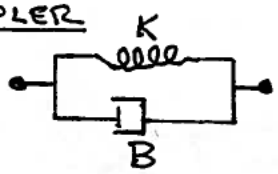


$F_s = F(t)$: LOCOMOTIVE

F_f = TOTAL WHEEL FRICTION

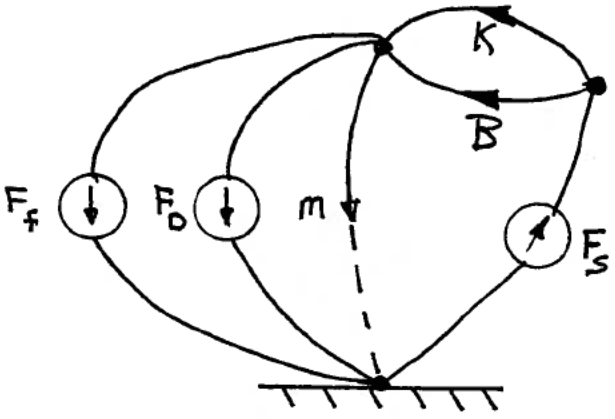
F_D = TOTAL AERODYNAMIC DRAG

COUPLER



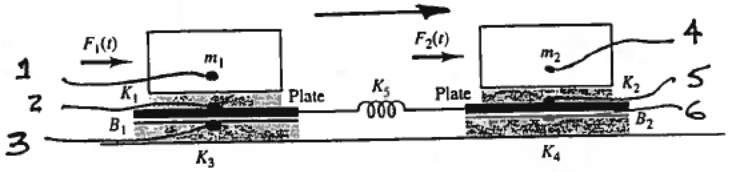
ELEMENTS IN PARALLEL OR ELSE COUPLER WOULD CONTINUE TO ELONGATE UNDER CONSTANT FORCE

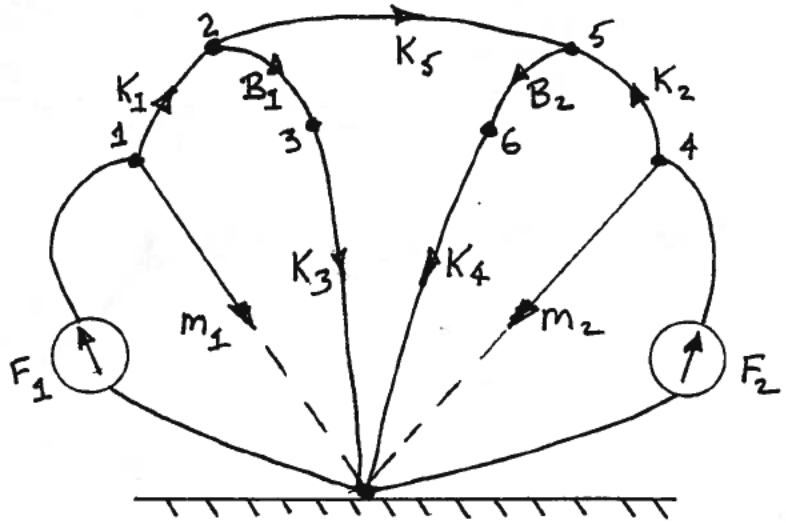
(b)



PROBLEM 4.5

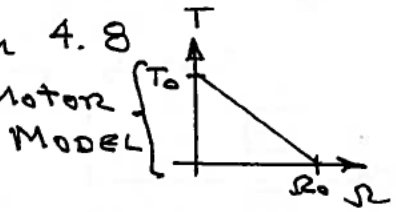
REFERENCE: +v





PROBLEM 4.8

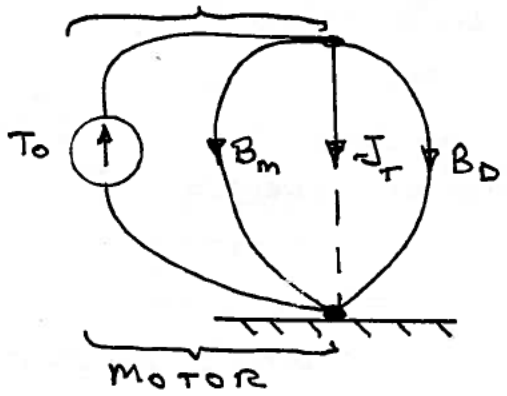
(a)



MOTOR MODEL { SOURCE: T_o ; DAMPER: B_m

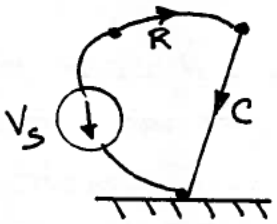
- BEARINGS : DAMPER, B_D
- WHEN ASSUME MOTOR SHAFT VERY STIFF, then total disc plus motor INERTIA IS J_T

(b)



PROBLEM 4.15

(i) THÉVENIN SOURCE V_S, R



(ii) NORTON SOURCE I_S, R