1. (20%)

The bar of mass *m* is released from rest in the position shown in Fig. 1, causing it to swing in the vertical plane. *G* is the position of mass center, and *a*, *b* are length distance between *A* and *G* and length of the bar, respectively. Determine the angular acceleration of the bar and the force exerted by pin *A* at the instant after release.

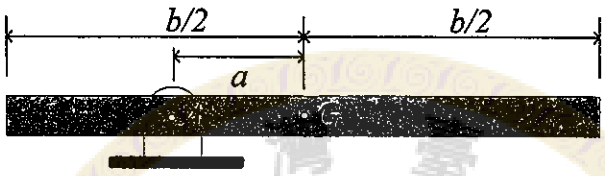

Fig. 1

2. (20%)

An electrical particle moves along the *x* axis. It has potential energy function *V*

$$V = 5x + 10/x$$

where *x* is the distance from the origin. Determine the equilibrium positions of the electrical particle. Determine whether the particle is stable or unstable at its equilibrium positions.

3. (20%)

Fig. 2 shows a jet of fluid striking normally again a fixed plate. The fluid issues from the nozzle with velocity *V*= 1200 m/s. The time rate of efflux of mass is *dm/dt*= 6.12 kg/s. Determine the force *F* that the fluid exerts on the plate. Neglect the gravity effect.

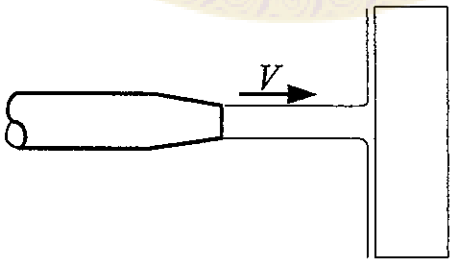

Fig. 2

4. (20%)

A rotating polishing wheel is lowered until it bears on a fixed rigid plate as shown in Fig. 3. *H* is the horizontal frictional force, and *N* is the normal force. The

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rotational velocity of the wheel is ω, and the radius of the wheel is r. Determine the work the plate performs on the wheel, and the work the wheel performs on the plate.

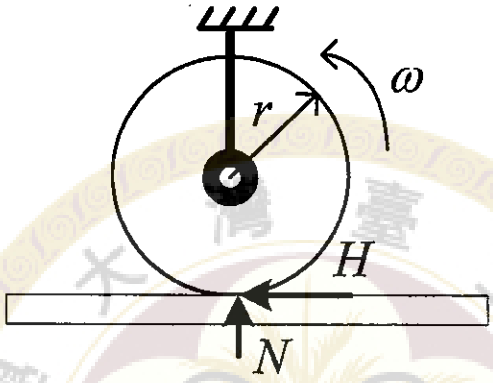

Fig. 3

5. (20%)
The 45 kg piston is supported by a spring of modulus k=35 kN/m. A damper of damping coefficient c = 1250N·s/m acts in parallel with the spring. A fluctuating pressure p = 4000 sin (30t) in Pa acts on the piston, whose top surface area is 50 10^{-3} m^2. Determine the steady state displacement as a function of time and the maximum force transmitted to the base.

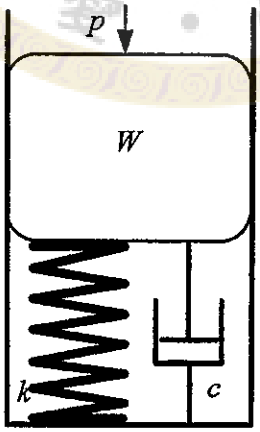

Fig. 4

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