

Please write down all critical steps in your answer. You can answer your questions in English or Chinese.

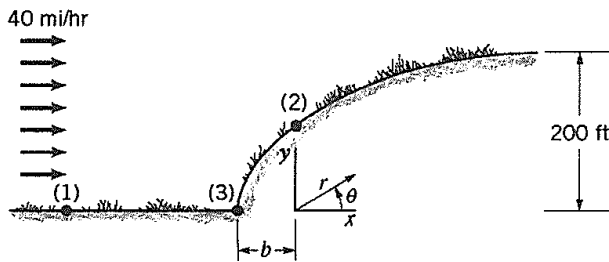
(請寫出重要計算步驟。可以英文或中文作答。)

1. (20 points) A simple relationship of particle fall velocity w_s has been proposed as

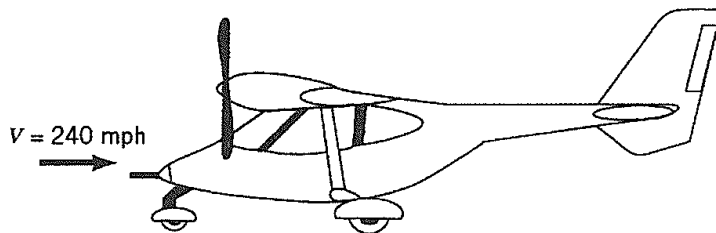
$$w_s = \frac{v}{d} \left(\sqrt{10.36^2 + 1.049d_*^3} - 10.36 \right)$$

where $d_* = \left(\frac{g \Delta}{\nu^2}\right)^{1/3} d$; $\Delta = (\rho_s - \rho) / \rho$; ρ_s = density of particles; ρ = density of fluid; g = gravitational acceleration; ν = a coefficient representative of fluid; and d = diameter of particles. Determine the dimension of d_* and ν .

2. (24 points) A 40mi/hr wind blows toward a hill rising from a plain that can be approximated with the top section of a half-body as illustrated. The height of the hill approaches 200 ft as shown. Assume an air density of 2.38 slugs/ft³.



- (1) What is the magnitude of the air velocity at a point (2) on the hill directly above the origin? (8 points)
 - (2) What is the elevation of point (2) above the plain? (8 points)
 - (3) What is the difference in pressure between point (3) and point (2)? (8 points)
3. (20 points) The drag on the airplane shown in the following figure cruising at 240 mph in standard air is to be determined from tests on a 1:20 scale model placed in a pressurized wind tunnel. To minimize compressibility effects, the airspeed in the wind tunnel is also to be 240 mph. Determine
- (1) The required air pressure in the tunnel (assuming the same air temperature for model and prototype) (use Reynolds number similarity) (10 points)
 - (2) The drag on the prototype corresponding to a measured force of 10 N on the model (use $2D/(\rho V^2 l^2)$ similarity learned in class where D is the drag force, V is the velocity and l is the characteristic length) (10 points)



4. (12 points) What are the major differences (assumptions, terms in the equation) between the Bernoulli equation and the energy equation derived from the Reynolds transport theorem? Express the difference in their governing equation mathematically and explain its physical meanings.

見背面

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國立臺灣大學 110 學年度碩士班招生考試試題

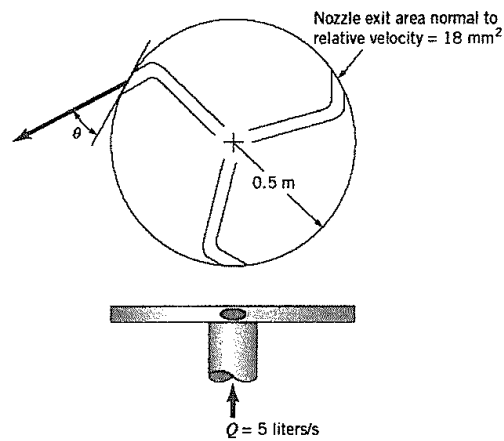
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5. (24 points) Five liters per second of water enters the rotor shown below along the axis of rotation. The cross-sectional area of each of the three nozzle exists normal to the relative velocity is 18 mm^2 . How fast will the rotor spin steadily if the resisting torque is reduced to zero, and (a) $\theta = 0^\circ$, (b) $\theta = 45^\circ$, or (c) $\theta = 60^\circ$? (8 points each)



試題隨卷繳回