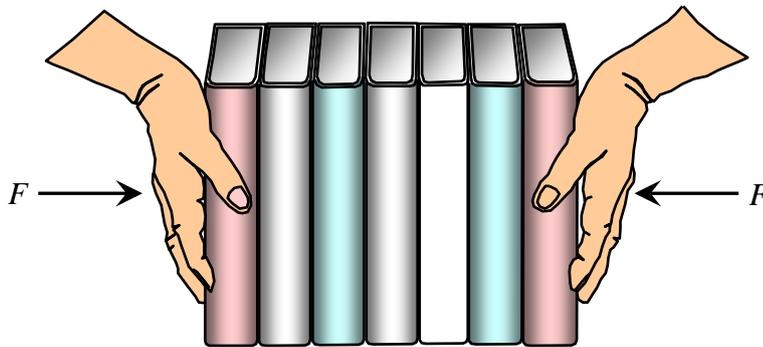
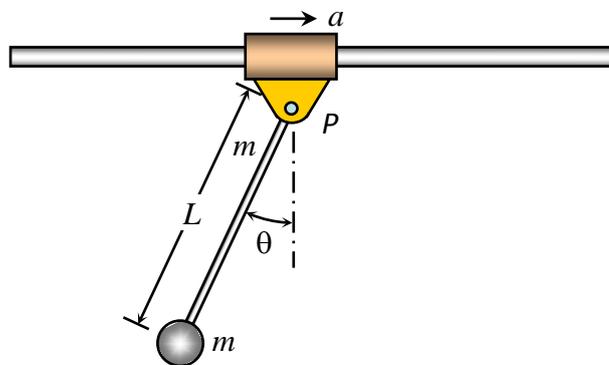


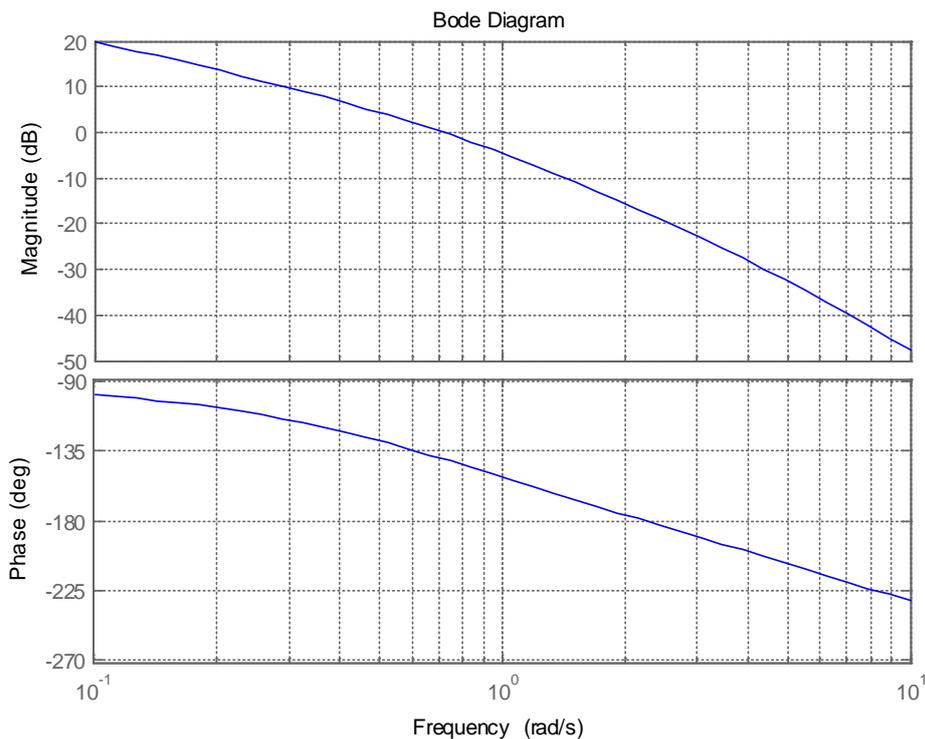
1. 有一支空心軸，當其承受 3,400 Nm 的扭矩時，其內部的剪切應力值為 55 MPa。已知該軸的內徑為外徑的 0.65 倍，請你計算該軸的外徑應為多少？ (20%)
2. 為什麼金屬粉末冶金製品容易發生製品內部密度分佈不均的狀況，請說明之。 (15%)
3. A student supports a stack of books by applying a horizontally compressive force of $F = 100$ N to both ends of the stack with his hands. Each book has a mass of 0.8 kg. The value of acceleration of gravity is $g = 9.81$ m/sec². The coefficient of static friction between the hands and a book is $\mu_1 = 0.6$ and between any two books is $\mu_2 = 0.4$. Determine the greatest number of books that can be supported in the stack. You must draw the necessary free body diagrams in solving this problem. (18%)



4. A pendulum comprises a particle and a slender rod, and it is hung from a collar moving along the horizontal guide with acceleration a . The slender rod of length L and the particle each have mass m . Friction at the pivot P is ignorable. Determine the acceleration a will result in a *steady-state* (angular acceleration $\alpha = 0$) deflection angle $\theta = 25^\circ$ of the pendulum from the vertical. Drawing the necessary free body diagrams is required in solving this problem. (17%)



5. 某機械系統之轉移函數(Transfer Function)頻率響應波德圖(Bode plot)如下圖所示，請估算此系統之(1)頻寬(以 Hz 表示) $0.7\text{rad/sec}=0.111\text{Hz}$, (2)增益裕度(Gain margin) 18db , (3)相位裕度(phase margin) 43deg , (4)增益交越頻率(gain crossover frequency) $0.7\text{rad/sec}=0.111\text{Hz}$, (5)相位交越頻率(phase crossover frequency) $2.3\text{rad/sec}=0.366\text{Hz}$. (15%)



6. Consider the mass-spring-friction system shown in following figure. The linear motion concerned is in the horizontal direction. (a) Find the transfer function $Y(s)/F(s)$ of the system. (b) Find the characteristic equation of the system. (15%)

