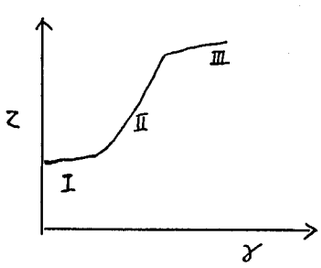
機械材料部份：

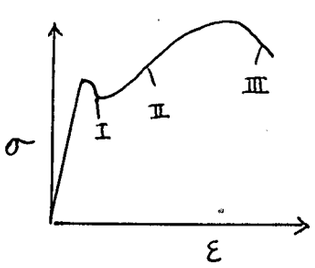
1. 金屬原子鍵結方式與其它固体原子鍵結方式有何不同？
金屬氧化物，如 SiO_2；金屬碳化物，如 SiC；金屬氮化物，如 Si_3N_4；
各屬於何种鍵結？三者之鍵結有何不同？ (10%)

2. 有四种單晶材料：(a)面心立方金屬，(b)体心立方金屬，(c)離子鍵結化合物，(d)共价鍵結化合物。請列出差排在結晶內主要滑移系統上所遇到阻力之大小之順序。 (10%)

3. 鋼材通常由許多結晶所組成，請問：
(a) 晶粒愈小，常温硬度是否愈小？ (2%)
(b) 為何如此？ (2%)
(c) 晶粒愈大，韌性是否愈佳？ (2%)
(d) 晶粒愈大，疲勞性能是否愈佳？ (2%)
(e) 晶粒愈大，高温潛变性能是否愈佳？ (2%)

4. 

左圖為某一單晶純金屬之剪切应力 (τ) 一剪切应变 (γ) 曲線。請問在 I, II, III 区域內，差排在滑移系統上之運動方式有何不同？ (10%)

5. 

左圖為某一多晶純金屬之拉伸真应力 (σ) 一真应变 (ε) 曲線。請依差排之觀点說明在 I, II, III 区域時，為何呈現如此？ (10%)

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機械製造部份

1. A round rod of annealed 302 stainless steel is being drawn from a diameter of 10 mm to 8 mm at a speed of 0.5 m/s. Assume that the frictional and redundant work together constitute 40% of the ideal work of deformation.

(a) What is the engineering strain in this operation ? (2%)

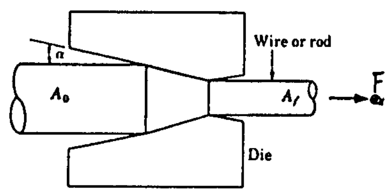
(b) What is the true strain in this operation ? (3%)

(c) If the material exhibits the true stress- true strain behavior of $\sigma = K\varepsilon^n$, where k= 1300 Mpa and n=0.3. What is the average flow stress $\bar{Y}$? (5%) (先導出 $\bar{Y}$ 的公式，否則只給3分)

(d) What is the drawing force F ? (2%)

(e) How much is the ideal power needed ?(3%)

(f) How much is the actual power needed ?(2%)

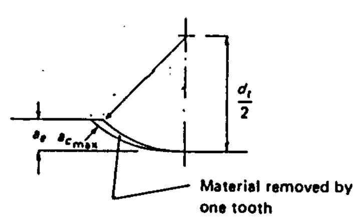


2. In a slab-milling operation, the cutter has 20 teeth and d_t=100 mm in diameter. The rotational frequency of the cutter is 5 sec^{-1}, the workpiece feed speed is v_f = 1.3 mm/sec., the working engagement (depth of cut) is a_e= 6mm, and the back engagement (width of the workpiece) is 50mm.

(a) Find the feed per tooth a_f (2%)

(b) Derive the maximum undeformed chip thickness a_{cmax} in terms of frequency, v_f, a_e, and d_t.(5%)

(c) Find the metal-removal rate (2%)



3. List the possible methods of making holes (5%)

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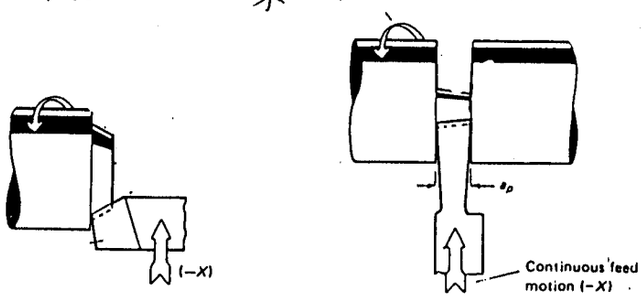
4. Show major cutting edge, minor cutting edge, work surface, machined surface, transient surface on the following cutoff and facing operation (5%) (請畫圖於答案紙上,再作答)



5. A 9 in. wide 6061-O aluminum strip (k= 30,000 Mpa and n=0.2.) is rolled from a thickness of 1 in. to 0.8 in, If the roll radius is 12 in. and the roll rpm is 100.

(a) Find the arc of contact L=? (3%)

(b) Find the true strain (2%)

(c) Find the average flow stress $\bar{Y}$=?(3%)

(d)The roll force F for low frictional conditions =? (3%)

(e) The power required = ?(3%)