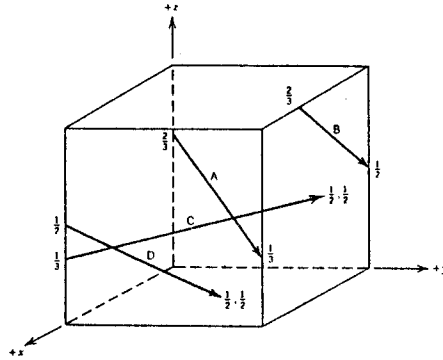


(1). Cite the relative Burgers vector-dislocation line orientations for edge, screw and mixed dislocations. (5%)

(2). The metal rhodium has a FCC crystal structure. If the angle of diffraction for the (311) set of planes occurs at 36.12° (first-order reflection) when monochromatic x-radiation having a wavelength of 0.0711 nm is used, compute (a) the interplanar spacing for this set of planes, and (b) the atomic radius for a rhodium atom. (8%)

(3). Determine the indices for the directions shown in the following cubic unit cell: (8%)



(4). An FCC iron-carbon alloy initially containing 0.10 wt% C is carburized at an elevated temperature and in an atmosphere wherein the surface carbon concentration is maintained at 1.10 wt%. If after 48 h the concentration of carbon is 0.30 wt% at a position 3.5 mm below the surface, determine the temperature at which the treatment was carried out. (7%)

(5). (a) Cite the primary differences between elastic, anelastic, and plastic deformation behaviors. (b) Cite five factors that lead to scatter in measured material properties. (8%)

(6) (a) what is slip system? (b) Determine the slip system for the FCC structure. (8%)

(7). If a hypereutectoid steel is slowly cooled from the austenite region, the primary cementite crystals form a continuous layer in the austenite grain boundaries. This brittle network seriously reduces the ductility of the steel at room temperature. What heat treatment would be most effective in removing this cementite network? (6%)

(背面仍有題目,請繼續作答)

1. 如圖所示乃是車床欲車斷半徑為 R 的圓形工件。車床主軸為 n rpm, 主切刃長 l mm, 進給 v_f mm/sec. 轉速

a. 主軸的角速度 $\omega = ?$ rad/sec (2%)

b. 工件相對於刀具的總速度 $\vec{v}_{res} = ?$ (x, y, z 及 v_f 表示在座標系 (x, y, z)) (3%)

c. 主切刃的向量 $\vec{\rho} = ?$ (表示在 (x, y, z)) (3%)

d. 若此為正切削, 則 $\delta = \delta_{orth} = ?$ (3%)

e. 在 $\delta = \delta_{orth}$ 下, 切屑的面積 $A_c = ?$ (3%)

f. 在 $\delta = \delta_{orth}$ 下, 體積切削率 $Z_w = ?$ mm³/sec (表示成 r 的函數) (3%)

2. 解釋名詞 (5%)

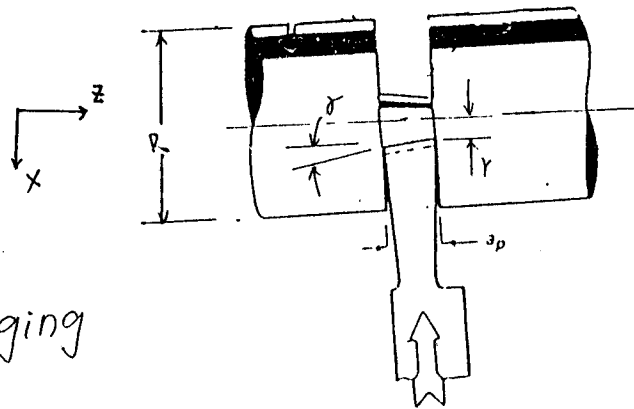
a. riser (冒口)

b. chill (冷塊)

c. core (砂心)

d. 「cold shut」 in forging

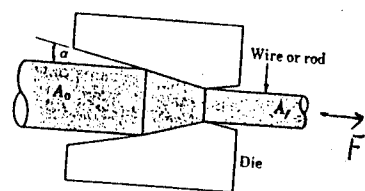
e. 2-piece can



3. 在 Die casting 中有 hot-chamber die-casting process 及 cold-chamber process. 試就 (a) 其澆注系統外形上的差異 (b) 所能澆鑄金屬之溶桌高低 (c) 生產速度快慢 (d) 鑄件品質 (e) 澆注系統壽命 作詳細說明. (10%)

(背面仍有題目, 請繼續作答)

4. 如图是 wire drawing, 素材面積為 A_0 ,
長度 L_0 。成品面積為 A_f



(1) 其真應變 (true strain) = ? (2%)

(2) 若材料是 perfectly plastic material
且不考慮 friction 之影响, 則單位體積
所須的功 $u = ?$ (2%)

(3) 完成此过程須總功 (total work) $W = ?$ (2%)

(4) 拉力 $F = ?$ (2%)

5. 鑽床其鑽頭為 2 刃鑽頭, 鑽床主軸轉速為 n rpm, 進給為
 V_f mm/sec, 孔深為 l mm, 孔徑為 d mm, 鑽頂角為 2θ .

(1) 切削時間 $t_m = ?$ (2%)

(2) 切屑厚度 $a_c = ?$ (2%)

(3) 切屑寬度 $a_e = ?$ (2%)

(4) 切屑面積 $A_c = ?$ (2%)

(5) 作積切除率 $Z_w = ?$ (2%)