ME58120320 HW#2

Due: July 8th (Monday) at 8:00 AM before lecture

Ch 4: Grinding

1. In the traverse surface grinding of a steel workpiece, 3 inch by 6 inch by 9 inch large, as shown in the following figure, the 90 grit aluminum oxide grinding wheel has a diameter of 6 inches. The cross feed (*f*) used is 1/4 inch, the radial depth of engagement is 1/16 inch, the spindle speed is 3,500 rpm, and the traverse speed is 1 in/s. In this case the grain aspect ratio is 4

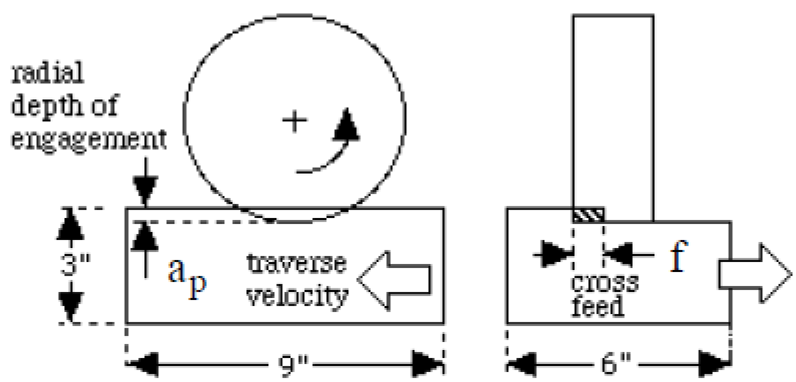
(1) Determine the total time needed to grind one flat surface. (18 points)
(2) In order to cut down the grinding time by 50%, it has been suggested that either
Option 1. the cross feed should be doubled, or
Option 2. the traverse speed should be doubled.

If the same grinding wheel is to be used while any of the above suggestions is followed, what is the effect of each option on the change of wheel hardness grade in grinding? (13 points)

Hint:

The wheel hardness grade in grinding is determined by the maximum uncut chip thickness, $a_{c,max}$. The increase in $a_{c,max}$ tends to make wheel behave softer.

When using the equation $a_{c,max}^2 = \frac{4v_{trav}}{G_g r_g v_t}\left(\sqrt{\frac{f}{D_s}}\right)$ in Chap. 4 to calculate $a_{c,max}$, please note that the *f* in this equation is for plunge grinding. This is the transverse grinding configuration.



2. Explain the following specification of a grinding wheel (21 points)
39C60-IVK
10 X 1-1/2 X 1-1/4

Ch7: Mechanics of Machining

1. In modeling the metal cutting, the simplest model is the orthogonal cutting with the work-material shearing occurs in a plane, commonly called the shear plane. For the AISI 1020 carbon steel, machining tests with feed or uncut chip thickness, t, of 0.5 mm was conducted. The average thickness of the chip, t_c, is 0.8 mm. The rake angle of the perfectly sharp tool is 10°. The width of cut is 8 mm and cutting speed is 200 m/min. Based on machining test conducted, the shear stress τ across the shear plane is 165 MPa and the friction angle β on the tool rake surface is 35° for the work-material. Based on the information, estimate:
(i) The shear angle, ϕ (5 points)
(ii) The shear force across the shear plane, F_s (5 points)
(iii) The magnitude of the resultant force, R, on the tool (5 points)
(iv) The cutting force (F_P) and thrust force (F_Q), which are parallel and perpendicular to the cutting direction, respectively (8 points)
(v) Calculate V_c (chip velocity) and V_s (shear velocity) (8 points)
(vi) The material removal rate in mm^3/s (5 points)
(vii) The specific cutting energy, specific shear energy, and specific friction energy in J/mm^3 (12 points)