نظرية وتكنولوجيا تشغيل المعادن

Kafrelsheikh University
Department of Mech. Eng.
Subject: Theory & Tech of Machining MDP3216
Third Year (Tow pages)

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Faculty of Engineering
Final Exam (23-5-2018)
Time: 3 hr
Full Mark 75

This Exam measure the following llos, a.8, a.13, b.2, b.18, c.5, and d.3
Answer the following with net sketch

Question no. One (10 Mark)

a- Define the difference between roughing and finishing operations in machining, describe in words what the Merchant equation tells us, and why machining is important commercially and technologically?

b- Defined the following (a machine tool, machining, cutting conditions, turning process, shaping and planning)

c- Turning is performed on a work material with shear strength of 250 MPa. The following conditions are used: v = 3.0 m/s, f = 0.20 mm/rev, d = 3.0 mm, and rake angle = 7° in the direction of chip flow. The resulting chip ratio = 0.5. Using the orthogonal model as an approximation of turning, determine: (a) the shear plane angle; (b) the shear force; (c) cutting force and feed force.

Question no. Two (20 Mark)

a- Difference, with net drawing, between basic types of chip.

b- How can the forces acting in metal cutting? Draw force diagram showing geometric relationships between these forces.

c- Consider a turning operation performed on steel whose hardness = 225 HB at a speed = 3.0 m/s, feed = 0.25 mm, and depth = 4.0 mm. Compute an estimate of cutting temperature using the Cook equation. Assume ambient temperature = 20°C. knowing that U=2.8 J/mm3, ρ = 7.87 g/cm3, C=0.46 J/g-°C, k=0.046 J/s-mm-°C

Question no. Three (15 Mark)

a- What are those problems associated with the use of cutting fluids? and what are some of the new problems introduced by machining dry?

b- What are the operations related to turning? And what are the common methods used to hold workparts in turning.

c- Tool life tests in turning yield the following data: (1) v = 100 m/min, T = 10 min; (2) v = 75 m/min, T = 30 min. (a) Determine the n and C values in the Taylor tool life equation. Based on your equation, compute (b) the tool life for a speed of 90 m/min, and (c) the speed corresponding to a tool life of 20 min.

Question no. Four (15 Mark)

a- With net drawing how you can get the product shown in Fig1-a from Fig1-b?

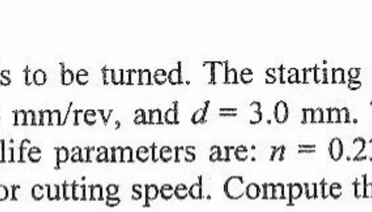

Fig 1 a   Fig 1 b

b- What are the types of milling operations? Discuss the mechanisms that cause wear at the tool–chip and tool–work interfaces in machining

c- The outside diameter of a cylinder made of titanium alloy is to be turned. The starting diameter = 500 mm and the length = 1000 mm. Cutting conditions are: f = 0.4 mm/rev, and d = 3.0 mm. The cut will be made with a cemented carbide cutting tool whose Taylor tool life parameters are: n = 0.23 and C = 400. Units for the Taylor equation are min. for tool life and m/min for cutting speed. Compute the cutting speed that will allow the tool life to be just equal to the cutting time for this part.

Question no. Five (15 Mark)

a- What are the tool life criteria that are more convenient to use in a production machining operation?

b- Discuss the cutting-tool materials, and what are the types of cutting fluids and its functions?

c- Three tool materials are to be compared for the same finish turning operation on a batch of 100 steel parts: high speed steel, cemented carbide, and ceramic. For the high speed steel tool, the 170 Taylor equation parameters are: $n = 0.125$ and $C = 70$. The price of the HSS tool is $15.00 and it is estimated that it can be ground and reground 15 times at a cost of $1.50. Tool change time = 3 min. Both carbide and ceramic tools are in insert form and can be held in the same mechanical tool holder. The Taylor equation parameters for the cemented carbide are: $n = 0.25$ and $C = 500$; and for the ceramic: $n = 0.6$ and $C = 3{,}000$. The cost per insert for the carbide = $6.00 and for the ceramic = $8.00. Number of cutting edges per insert in both cases = 6. Tool change time = 1.0 min for both tools. Time to change parts = 2.0 min. Feed = 0.25 mm/rev, and depth = 3.0 mm. The cost of machine time = $30/hr. The part dimensions are: diameter = 56.0 mm and length = 290 mm. Setup time for the batch is 2.0 hr. For the three tooling cases, compare: (a) cutting speeds for minimum cost, (b) tool lives, (c) cycle time, (d) cost per production unit, (e) total time to complete the batch and production rate. (f) What is the proportion of time spent actually cutting metal for each tooling?

Good Luck

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