

## MKT 4161 MANUFACTURING TECHNIQUES

### HW-3

**Due: 13/11/2017 (Beginning of MT1)**

From Kalpakjian and Schmid's "Manufacturing Engineering and technology" book (5th Ed.).

*1. ODD Numbers:* A mechanical press is powered by a 18-kW motor and operates at 30 strokes per minute. It uses a flywheel, so that the crankshaft speed does not vary appreciably during the stroke. If the stroke is 100 mm, what is the maximum constant force that can be exerted over the entire stroke length?

*EVEN Numbers:* motor power is 21 kW, press speed is 20 strokes/min.

*2. ODD Numbers:* What is the minimum bend radius for a 0,8-mm thick sheet metal with a tensile reduction of area of 25%? Does the bend angle affect your answer? Explain.

*EVEN Numbers:* Sheet thickness is 2,5 mm and reduction of area of 20%

*3. ODD Numbers:* What is the force required to punch a square hole 50 mm on each side with a corner radius of 5 mm in a 2,5 mm-thick 2024 T4 aluminum sheet by using flat dies? What would be your answer if beveled dies are used?

*EVEN Numbers:* 0,8 mm St-52 steel sheet.

You should discover the material properties of the metal alloys of this problem in the internet. Do not forget to give your reference.

*4. ODD Numbers:* Calculate  $R_{avg}$  for a metal where the  $R$  values for the  $0^\circ$ ,  $45^\circ$ , and  $90^\circ$  directions are 0.7, 1.4, and 1.8, respectively. What is the limiting drawing ratio (LDR) for this material?

*EVEN Numbers:*  $R$  values are 1,2, 1,6 and 2.0

*5. ALL Numbers:* Calculate the  $\Delta R$  for problem 4. Do you expect earing? If so, how severe?

**Exercise:** (DO NOT TURN IN)

**16.18.** Explain the differences that you have observed between products made of sheet metals and those made by casting and forging.

**16.19.** Identify the material and process variables that influence the punch force in shearing, and explain how each of them affects this force.

**16.20.** Explain why springback in bending depends on yield stress, elastic modulus, sheet thickness, and bend radius.

**16.21.** Explain why cupping tests may not predict well the formability of sheet metals in actual forming processes.

**16.22.** Identify the factors that influence the deep-drawing force,  $F$ , in Fig. 16.31b, and explain why they do so.

► **16.35.** Estimate the limiting drawing ratio for the materials listed in Table 16.4.

Calculate the minimum tensile true fracture strain that a sheet metal should have in order to be bent to the following  $R/t$  ratios: (a) 0.5, (b) 2, and (c) 4. (See Table 7.2.)

Estimate the maximum bending force required for a  $\frac{1}{8}$ -in. thick and 12-in. wide Ti-5Al-2.5Sn titanium alloy in a  $V$ -die with a width of 6 in.