

Exam in Modern Manufacturing Processes MPR 033

- Date:** 2009-10-19
- Time:** 14.00-18.00
- Examiner:** Gustav Holmqvist, tel. 5026, 0709-393275
Will visit the exam about 15.00 and 16.30.
- Ass. Devices:** Approved calculator, pen, pencil, eraser, ruler, and written dictionary.
- Credit list:** Will be sent out by e-mail 2009-11-09
- Checking:** Checking of your exams can be made 2009-11-11, 12.30-13.15, place to be announced.
- Grading** Fail: 0-19,5p, 3: 20-29,5p, 4: 30-39,5p, 5: 40-50p

(Extra points based on your group assignment report will be added to your exam result)

General instructions: For full point you must make clear that you have understood the meaning of your answer. You must show the teacher that you have understood the question and it's answer. Write detailed answers and motivate and explain yourself. Write clearly and readable. Good Luck!

Unconventional machining methods

1. Abrasive Waterjet Cutting (5p)

- a) AWJ cut surfaces are a result of the different wear mechanisms. Describe these and point out where they are typically found on a surface. (2 p)
- b) If considering a straight cut with AWJ (no corners); What geometrical characteristics does the surface have on the micro and macro scale? Relate to question 1a but also include geometrical defects in your answer. Make appropriate sketches. (Note: Not the corner-type defects). (3 p)

2. Laser and Plasma cutting (6p)

- a) Make a general comparison between laser and plasma cutting concerning: applications, edge quality, economy and some other factor of your own choice. (4 p)
- b) Lasers and Plasma uses gases in the processes. Discuss briefly the different uses of gases in the two processes. (2 p)

3. Chemical machining (4p)

- a) Describe Photo-chemical machining. Describe the steps in making a part. Make appropriate sketches. (3 p)
- b) Why does this process (PCM) exist? What applications are there? (1 p)

Metal forming

4. Roll forming (5p)

- a) Describe roll forming, it's function and give some typical application. (2p)
- b) Why do you get *springback* in roll forming? You may also describe for bending. (2p)
- c) Is there an advantage or a disadvantage in using high-strength steels with the respect to springback in roll forming? Explain briefly. (1p)

5. Drawing – wrinkles (4p)

- a) Explain *why* and *where* wrinkling occurs in drawing. Explain also how wrinkles are *avoided* (2,5p)
- b) In a forming limit diagram, try to point out where (approximately) wrinkles might occur. (Draw your own in the answer paper). (1,5 p)

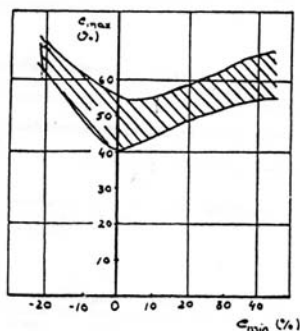


Figure: Example of FLD.

6. Hydroforming (4p)

- a) What main process parameters are there in hydroforming? Name and describe at least three. (1,5 p)
- b) What is crash-forming (or crush forming) in hydroforming? (1 p)
- c) In the literature is discussed a cost aspect of the so called clamping force. What is the clamping force and what is the “problem” in economical terms? Clue: how is the clamping force normally provided today? (1,5 p)

Metal Cutting

7. Grinding (5p)

- a) Name and explain at least three characteristic properties of a grinding wheel. The properties should be among those found in the designation (coding) of a grinding wheel. (3 p)
- b) Higher temperatures arise in grinding than other metal cutting processes – why? (1 p)
- d) What negative effects do high temperatures have? At least two effects should be mentioned and *very briefly* explained/discussed. (1 p)

8. Metal Cutting Fluids (5p)

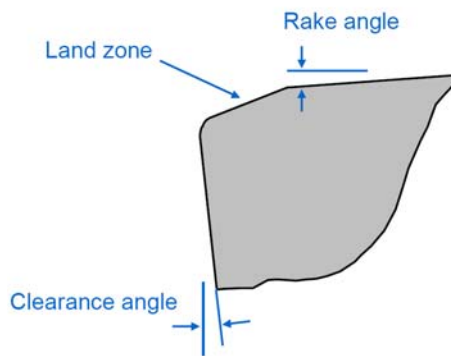
- a) What are the general functions (or motivations) of a cutting fluid? Name at least three and explain at least two. (3 p)
- b) How well can MQL provide for these functions? Are they “functioning” in the same way, worse or not at all? Compare to ordinary cutting fluid application. (2 p)

9. High-Speed Machining (5p)

- a) Explain why thinner walls are possible to machine with HSM in for instance Aluminium. (2,5p)
- b) *How* and *why* can the process chain for producing dies in hardened steel be changed with HSM? What is the advantage of HSM? (2,5p)

10 Metal cutting tools (3p)

The picture in below shows the edge of a cutting insert.



- Why is an edge made in this way – why is there a land zone? Is there any negative effect of this geometry? (2p)
- For what insert material (or materials) would you expect to find this type of geometry? (1p)

11. Surface Topography (4p)

- What are the general advantages of using a 3D-measurement instead of a 2D measurement? (2p)
- Explain the use of filtering in surface topography characterization. Which three surface characteristics do you typically want to distinguish? (2p)