

Advanced Machining Processes

Quiz 5

Name: _____ **Solution** _____

1. In drilling:

- a) The portion of cutting modeled in class occurs along the _____ cutting _____ lips.
- b) Normal rake angle **varies substantially** along the cutting edge? Circle:

True

False

- c) The drilling force transformation from the rake-face force components to the x - and y -force components looks exactly like that of boring. The difference is that two angles used in the transformation **vary significantly** with edge position r in drilling but do **not vary significantly** with edge position s in boring. Circle two:

Tooth Angle θ_i Lead Angle ψ_r

Inclusion Angle λ

Normal Rake Angle γ_n

- d) **Briefly**, describe the type of cutting that occurs along the chisel edge.

In a small region around the axis of the drill, the material is extruded (squished) outward. Surrounding the extrusion region, orthogonal cutting occurs at a very negative rake angle.

2. With respect to **surface error**:

- a) Functional performance of a machined product significantly depends on _____ surface error _____, among other things. Two words — this is a gimme!
- b) What are the three components of surface error in order of **increasing size-scale** (from left to right).

Finish/Roughness

Waviness

Form

3. Regarding an increase in corner radius and lead angle,

- a) Which surface error component(s) would such a change mainly affect?

Surface Roughness

Waviness

Form

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Quiz 5

- b) **Briefly**, describe how these changes would affect each of the above surface error component(s).
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The static depth force increases, all else held constant, which subsequently causes the tool and workpiece to separate more, leading to increased form error.

The depth force variation, via tool-work separation, but time varying (vibration), increases waviness amplitude.

The increase in corner radius would reduce the cusp height and therefore reduce the surface roughness.

4. Name and describe two parameters associated with surface roughness.

- a) Parameter 1:
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Peak-to-valley: Distance from the highest peak to the lowest valley

Centerline: The line for which the area above and below is equal.

Roughness Average: The average of the absolute value of the roughness less the centerline.

RMS Average: The square-root of the average of the square of the roughness less the centerline.

Zeroth Spectral Moment: The variance of the roughness height about the centerline.

Second Spectral Moment: The variance of the roughness slope.

Fourth Spectral Moment: The variance of the roughness curvature.

- b) Parameter 2:
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See above for all parameters discussed.

5. **Briefly**, describe the difference and/or commonality between production cost and product cost.
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Production cost is the cost to produce a part. One component of product cost is production cost; however, product cost involves the cost to support that product over its lifetime (e.g., warranty cost) and the cost/reward of bad/good reputation.