

Advanced Machining Processes

Quiz 1

Name: _____ **Solution** _____

1. For each machining process below, describe in a few words (or sketch) what type of surface it is used to create.

a) Turning?

Externally axisymmetric (cylindrical or profiled) surfaces.

b) Face Milling?

Large flat surfaces.

c) Drilling?

A round hole in a surface where no hole preexisted, or (though not typical) to enlarge an existing hole).

d) Counter Boring?

An enlargement of a round hole of shallow depth down from the surface and with its sides being square with the surface (unlike counter sinking, which provides tapered sides).

2. **What** variables are needed to relate the chip velocity and shear velocity to the cutting velocity, and from **where** can the values of these variables be obtained? **Hint:** There are two variables.

Rake Angle, γ : obtained from knowing (since it is a set/controllable variable) the tool geometry.

Shear Angle ϕ : measured (based on chip measurement or maybe visually under high magnification while cutting), or predicted with a model (e.g., Lee & Shaffer or Ernst & Merchant).

3. **Briefly**, explain why one is interested in knowing the chip and shear velocities for cutting process modeling?

Because multiplying these velocities (speeds) by the force in their respective directions yields shear power and friction power, the two of which can then be related to energy per unit volume of material removed per unit time.

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4. **Briefly**, explain the usefulness of a machining process model?

To predict the performance/behavior of a machining process/operation before having the actual process and equipment set up (i.e., in planning) or later for optimization and troubleshooting problems (diagnostics) of the system after it has been built.

5. Name three assumptions made in cutting process modeling, and **briefly** comment on their validity/goodness.

a)

No built-up edge (BUE): Not good at certain speeds and uncut chip thickness when contact stress and temperature are high local to the cutting edge, which enhances adhesion.

b)

Ideally Sharp Edge: This never truly exists, though “up-sharp” tools are close to perfectly sharp. When bluntness is intentionally added to the tool to avoid edge fracture, its effects are fairly well captured in the empirical portion of the model.

c)

Shear Plane: This is reasonable at practically high cutting speeds where the shear zone becomes relatively thin.