

Advanced Machining Processes

Quiz 3

Name: _____ **Solution** _____

1. Not seen in orthogonal cutting, a phenomenon (characteristic behavior) exists in oblique cutting that results in force components **out of** (perpendicular to) **the ‘normal plane’**. What is this phenomenon/behavior?

Chip Flow Direction

2. What two angles are used for the two-step rotational transformation from the external C - T - L coordinate system to the
- a) **rake face coordinate system** in which the normal and in-plane rake face force components are viewed?

λ = Inclination Angle & γ_n = Normal Rake Angle

- b) **shear plane coordinate system** in which the normal and in-plane shear force components are viewed?

λ = Inclination Angle & ϕ_n = Normal Shear Angle

3. Regarding ‘specific energy’ values:

- a) Does the result of Merchant’s analysis, that $u_C = u_s + u_f$, hold in oblique cutting?

Yes

- b) In terms of a single force and a single velocity for each, what do u_C , u_s and u_f each equal in oblique cutting?

$$u_C = \frac{F_c V}{\dot{v}_r}, \quad u_s = \frac{P_\phi V_s}{\dot{v}_r}, \quad u_f = \frac{P_f V_c}{\dot{v}_r}$$

Continued on back

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4. Regarding modeling/viewing the turning process geometry:

a) What type of cutting **actually** occurs at any given point along the cutting edge?

Oblique

b) Based on turning tool geometry specifications (rake angles), why can cutting at any given point along the cutting edge be approximated as orthogonal, and how can inclination angle still be included in a **mathematically convenient manner**?

Inclination angle depends on γ_p and γ_f through $\cos\psi$ and $\sin\psi$. It is ignored in turning since γ_p and γ_f , and hence λ , tend to be small enough that forces are not influenced greatly by the inclination. One could include the effect of λ in the equivalent lead angle model as an additional directional effect.

c) What is a good approximation of the chip area in the turning process?

$$a = fd$$