AGE-1320
Section 1, CRN: 320/321/378
Section 2, CRN: 379/381/380

First Semester 1448 H (Fall 2026) – 2(1,1,2)
"Introduction to Manufacturing"

Sunday, October 18, 2026 (7/5/1448H)

Drilling Exercise + ANSWERS

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Material-Removal Rate in Drilling

A hole is being drilled in a block of magnesium alloy with a $10 - mm$ drill bit at a feed of $0.2\ mm/rev$ and with the spindle running at $N = 800\ rpm$. You are required to:

a) Calculate the material-removal rate

b) Compare the surface speed with the feed rate

Given:

- Workpiece material: magnesium alloy
- Process: drilling
- $D = 10\ mm$
- $f = 0.2\ mm/rev$
- $N = 800\ rev/min$

Solution:

a) **material-removal rate**, $MRR = \left[\frac{(\pi)(D^2)}{4}\right](f)(N)$

$$MRR = \left[\frac{(\pi)(10\ mm)^2}{4}\right]\left(0.2\ \frac{mm}{rev}\right)\left(800\ \frac{rev}{min}\right)$$

$$= 12566.37\ \frac{mm^3}{min} * \left(\frac{1\ min}{60\ s}\right) = 209.44\ mm^3/s$$

► $\boldsymbol{MRR = 209\ mm^3/s}$

b) Note, compare the surface speed (V) with the feed rate (or linear speed, v) in this problem:

$$\boldsymbol{V} = \pi DN = (\pi\ rad/rev)(10\ mm)(800\ rev/min) = 25{,}132.74\ mm/min = \mathbf{25.1\ m/min}$$

$$\boldsymbol{v} = fN = (0.2\ mm/rev)(800\ rev/min) = \mathbf{160\ mm/min}$$

i.e. V is much larger than v (157 times larger). Can you explain this?