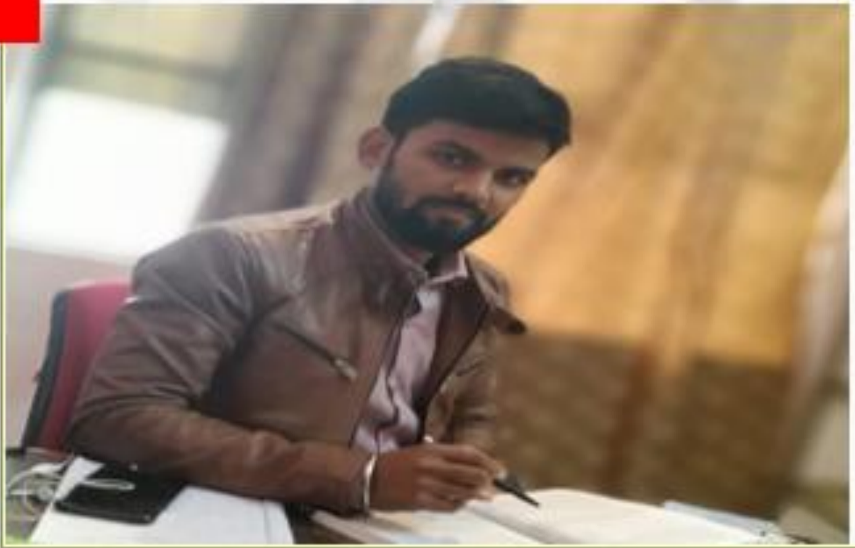
SUBODH KUMAR

M.TECH NIT SURATHKAL KARNATAKA

ASSISTANT PROFESSOR



MECHANICAL ENGINEERING LECTURE BY SUBODH KUMAR

GATE 2004

Ques In a machining experiment, tool life was found to vary with the cutting speed in the following manner.

Cutting speed (m/min) (V)	Tool life (minutes) (T)
60	81
90	36

find out the exponent (n) and constant (C) of The taylor's tool life equation.

An

Taylor's equation

$$VT^n = C$$

property
$\log(a \times b) = \log a + \log b$
$\log a^n = n \log a$

$$\log V + n \log T = \log C$$

(i) when cutting speed (V) = 60
Tool life (T) = 81

$$\log 60 + n \log 81 = \log C$$

$$1.778 + n\, 1.908 = \log C \quad \text{—— (1)}$$

(ii) when cutting speed (V) = 90
Tool life (T) = 36

$$\log 90 + n \log 36 = \log C$$

$$1.954 + n\, 1.556 = \log C \quad \text{——→ (2)}$$

⑥ ~~subtract~~ eqn (1) − eqn (2)

$$1.778 + n\,1.908 = \log c$$
$$1.954 + n\,1.556 = \log c$$
$$- \quad - \quad -$$

$$-0.176 + n\,0.352 = 0$$

$$n\,0.352 = 0.176$$

$$\boxed{n = 0.5}$$

put the value of n in eqn (1)

$$1.778 + 0.5 \times 1.908 = \log c$$

$\log c = 2.732$

$c = 539.51 \simeq 540$

$$\boxed{\begin{array}{l} n = 0.5 \\ c = 540 \end{array}}$$

Ans

$V_1 T_1^n = V_2 T_2^n$

$\frac{V_1}{V_2} = \left(\frac{T_2}{T_1}\right)^n$

$\frac{60}{90} = \left(\frac{36}{81}\right)^n$ --(1)

$0.666 = (0.444)^n$

take log on both side

$\log 0.666 = n \log (0.444)$

$0.176 = n\, 0.353$

$$\boxed{n = \frac{0.176}{0.353} = 0.5}$$

$V_1 T_1^n = c$ | $60 \times (81)^{0.5} = c$

$\boxed{c = 54}$

[illegible] the [illegible]

GATE 2004 IES 2000

Ques In a machining operation doubling the cutting speed reduces the tool life to $\frac{1}{8}$th of the original value. Find the exponent n in Taylor's tool life equation. $VT^n = C$, e.

(a) $\frac{1}{8}$ (b) $\frac{1}{4}$ (c) $\frac{1}{3}$ ✓ d $\frac{1}{2}$

~~Initial~~ ✓

~~Initials~~

	Cutting speed (V)	Tool life (T)
Initial	V	T
final	2V	$\frac{T}{8}$

$$VT^n = C$$

$n = ?$

$$V_1 T_1^n = V_2 T_2^n$$

$$\frac{V_1}{V_2} = \left(\frac{T_2}{T_1}\right)^n$$

$$\frac{V_0}{2V} = \left(\frac{I}{8I}\right)^n$$

$$\left(\frac{1}{2}\right) = \left(\frac{1}{8}\right)^n$$

$$\left(\frac{1}{2}\right)^{\frac{1}{n}} = \left(\frac{1}{2^3}\right)$$

$$\left(\frac{1}{2}\right)^{1/n} = \left(\frac{1}{2}\right)^3$$

$$\frac{1}{n} = 3$$

$$n = \frac{1}{3}$$ Ans

Question 1.15

UPTU - 2003-04

If taylor's tool life exponent $n = 0.5$ and constant $C = 400$, what will be the percentage increase in tool life when cutting speed is reduced to half.

Ans

Initial cutting speed $(V_1) = V$

final " " $V_2 = \frac{V}{2}$

$$VT^n = C$$

$$V_1 T_1^n = V_2 T_2^n$$

$$\left(\frac{V_1}{V_2}\right) = \left(\frac{T_2}{T_1}\right)^n$$

$$\left(\frac{2V}{V}\right) = \left(\frac{T_2}{T_1}\right)^{0.5}$$

$$(2)^{\frac{1}{0.5}} = \frac{T_2}{T_1}$$

$$\frac{T_2}{T_1} = (2)^2$$

$$\frac{T_2}{T_1} = 4$$

$$\boxed{T_2 = 4T_1}$$

% increase $= \dfrac{T_2 - T_1}{T_1} \times 100$

$= \dfrac{4T_1 - T_1}{T_1} \times 100$

$= \dfrac{3T_1}{T_1} \times 100$

$= 300\%$ Ans

THANKYOU