

Analysis of strip rolling - 2:

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1.Quiz- Key:

1. What is the effect of friction on rolling load?

Rolling load increases with friction.

2. Compare rolling load under sliding friction with sticking friction.

Rolling force in sticking friction is higher.

3. For plane strain rolling can the von Mises criterion be applied? Justify.

Both Tresca and von Mises criteria for plane strain condition give the same result. Therefore, we can apply either.

4. A certain strip has a thickness of 30 mm and width of 300 mm. It is being rolled between a pair of rolls of radius of 300 mm and has its thickness reduced to 25 mm in one pass. The rolls have a speed of 50 rpm. The work material has a strength coefficient of 300 MPa and $n=0.2$. Assume $\mu=0.15$. Under the given conditions is the reduction possible? If so calculate the rolling force using approximate method.

Solution:

We know that the maximum reduction is given by: $\Delta h_{\max} = \mu^2 R$

Maximum reduction = 6.75 mm. The reduction achieved is within the maximum possible reduction. Therefore this is feasible.

Roll load $F = Y' L w$

True strain $\varepsilon = \ln(h_0/h_f) = 0.182$

We can calculate $Y' = \frac{2}{\sqrt{3}} \bar{Y} = 205.39 \text{ MPa}$

Where $\bar{Y} = k \varepsilon^n / 1 + n = 177.87 \text{ MPa}$

Now, $L = \sqrt{R \Delta h} = 17.32 \text{ mm}$

Therefore, rolling load = 5.34 MN