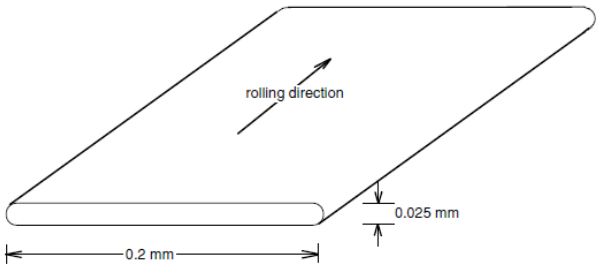
دانشگاه صنعتی اصفهان ، دانشکده مهندسی مواد

تمرین سری نهم شکل دادن فلزات، تاریخ تحویل: --/--/۹۹

1- Magnetic permalloy tape is produced by roll flattening of drawn wire, as shown in Figure. The final cross section is 0.2 mm by 0.025 mm. It is physically possible to achieve this cross section with different rolling schedules. However, it has been found that the best magnetic properties result with a maximum amount of lateral spreading. For production the rolling direction must be parallel to the wire axis. Describe how you would vary each of the parameters below to achieve the maximum spreading:

a) roll diameter,
b) reduction per pass,
c) the friction,
d) back and front tension.



2- Consider the rolling of a sheet 40 cm wide from a thickness of 2.0 mm to 1.2 mm in a single pass by steel rolls 38 cm in diameter. Assume a friction coefficient of 0.25 and a flow stress of 170 MPa.
a) Calculate the roll pressure if roll flattening is neglected.
b) Calculate the roll pressure taking into account roll flattening.
c) Estimate the minimum thickness that could be achieved.

3- Determine the maximum possible reduction for cold-rolling a 3 mm-thick slab when $\mu = 0.11$ and the roll diameter is 500 mm. What is the maximum reduction on the same mill for hot-rolling when $\mu = 0.3$?

4- A 450 mm-wide aluminum alloy strip is hot-rolled in thickness from 24 to 14 mm. The rolls are 0.6 m in diameter and operate at 120 rpm. The uniaxial flow stress for the aluminum alloy can be expressed as $\bar{\sigma} = 147\bar{\epsilon}^{\,0.25}$ MPa. Determine the rolling load and the power required for this hot reduction.

5- A sheet, 0.8 m wide and 12 mm thick, is to be rolled to a thickness of 9 mm in a single pass (the width is considered as constant : plane strain deformation). The strain-hardening expression for the material is $\bar{\sigma} = 240\bar{\epsilon}^{\,0.34}$ MPa. A deformation efficiency of 73% can be assumed. The von Mises yield criterion is applicable. The exit speed from the rolls is 5 m/s. Calculate the power required.

6- One stand of a hot-rolling mill is being designed. It will reduce 38-in.-wide sheet from 0.8 to 0.6 in. thickness at an exit speed of 15 ft/sec. Assume that the flow stress of the steel at the temperature and strain rate in the rolling mill is 1580 psi. If the deformation efficiency is 68% and the efficiency of transferring energy from the motor to the mill is 80%, what horsepower motor should be used?