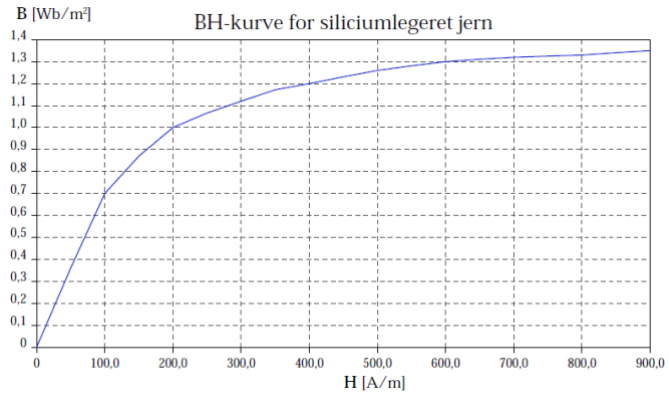
Exercise 4.1

The graph shows the BH curve for a transformer material. This task is solved graphically and approximately.



a. Determine μr for H = 200 A/m.

b. Determine μr for H = 400 A/m.

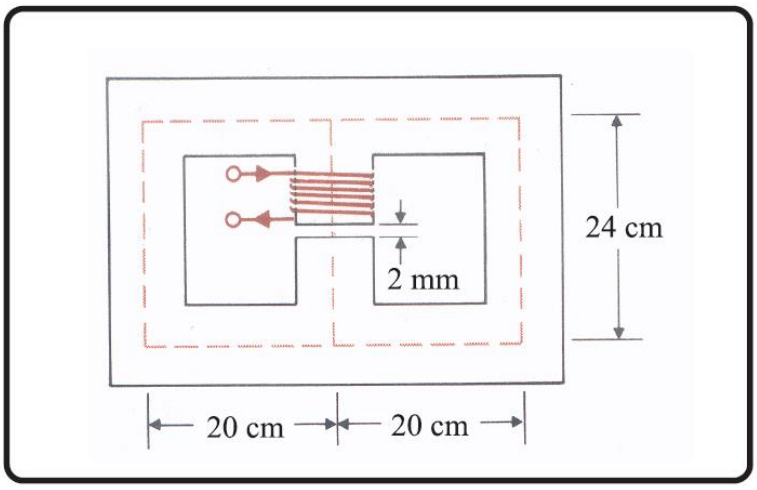
c. Determine the incremental μr when H varies between 150 A/m and 300 A/m.

d. Determine the initial permeability (relative permeability).

e. Determine the saturation flux.

Exercise 4.2

For the displayed transformer core, the iron has a BH curve as shown in the figure for Exercise 4.1. Use the permeability we found for 400 A/m (if you don't have a value, then use μr = 2,000). We are not considering hysteresis, and we assume the iron is linear. The winding consists of 200 turns, through which 4.5 A is sent. The cross-sectional area of the legs of the core is 0.001 m².



a. Draw a magnetic diagram for the core and calculate the necessary path lengths and areas. An area increase in the air gap is considered to be $(1 + \frac{2\ell}{\sqrt{A}})$

b. Determine the reluctances and complete the magnetic equivalent diagram.

c. Calculate the magnetic flux in each of the 3 legs.

d. Determine B and H in each of the 3 legs and in the air gap.

Exercise 4.3

The same core as in Exercise 4.2 is now connected to a voltage generator of 220 V (effective) at 50 Hz.

a. Determine the necessary flux in the core (middle leg).

b. Determine B and H in both the middle leg and the air gap.

Exercise 4.4

A coil has the following specifications:

Length: 1.2 m

Number of turns: 750

Diameter: 10 cm

Current: 1.75 A

The coil is "wrapped in air."

a. Calculate the H-field inside the coil.

b. Calculate the self-induction of the coil.