

ECE 18-316
INTRO TO DATA STORAGE
FALL 98
PROBLEM SET #9: Addendum

Due Friday, 11/6/98

In Class or To Jie Zou Before Start of Lab Section (1:30 PM)

Late submissions will not get credit

ASSUMPTION # 3 IN ASSIGNMENT # 9 IS INCORRECT

Assumption #3: - The bias field in the shunt biased head at the center of the MR can be calculated by treating the shunt/MR pair as wire with radius equal to half the MR thickness (as shown below)

***NOTE: ASSUME THIS FIELD IS INSIDE A PERMEABLE MATERIAL FOR CALCULATION ***

If followed, it will produce a tiny value of current in question 1a.

A better (though still quite approximate) approach for calculating the current is as follows:

- 1) Use Ampere's law to calculate the field around the path indicated in the corrected drawing below.
- 2) Assume that only the vertical (y-direction) branches of the path integral matter, and that the field is constant and parallel to each branch, over the length of each branch.
- 3) Assume that the bar has a constant internal demagnetizing field in the y-direction given by
$$H_d = -M_y * \text{thickness/height}$$
- 4) Assume the sensor has an intrinsic H_k , as given below, and that it has a hard axis in the y-direction.
- 5) Assume that the field everywhere inside the shunt has a magnitude of H_d
- 6) Assume everything else given in the original problem (nothing else bears on 1a, however)

Sensor H_k	500 A/m
Sensor M_s	800 kA/m
Medium field	100 A/m
Sensor height	10 μm
Sensor thickness	10 nm
Shunt thickness	10 nm
ρ_0	20 $\mu\text{Ohm-cm}$
$\Delta\rho_0/\rho_0$	2%

