Motor Design Assignment 2

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Here are some constant values used in the calculations;

Density of steel	7850kg/m^3
Density of copper	8940 kg/m^3
pf	0.9
J	3 A/mm^2

Firstly the required cross section area is calculated using the formula;

$$E = 4.44.N.f.\Phi_{max}$$

Then from the current density, the wire cross sections are calculated since the currents are known. According to the wire dimensions and the turn numbers the core height is calculated. The resulting core geometry is given in Figure 1.

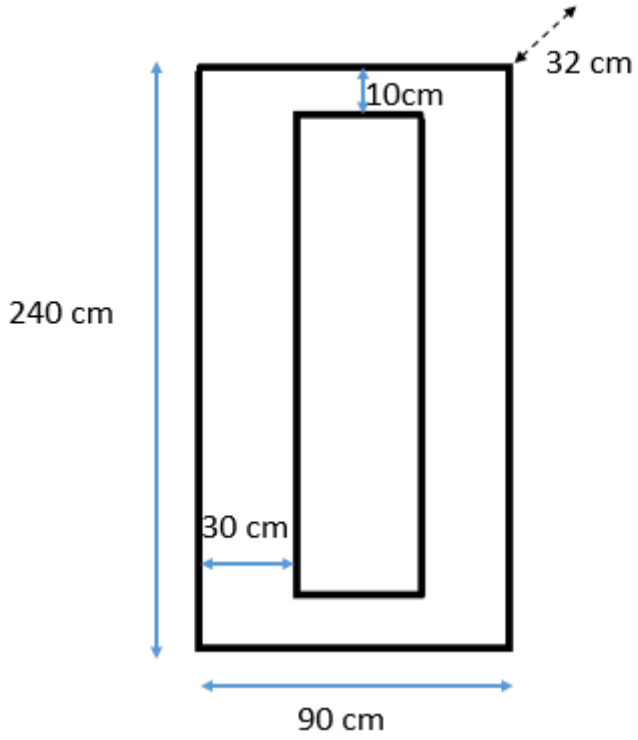

Figure 1

The chosen wire dimensions are given in Figure 2. The associated resistances can be calculated from $\rho \frac{l}{A}$, and the copper losses are obtained from i^2r.

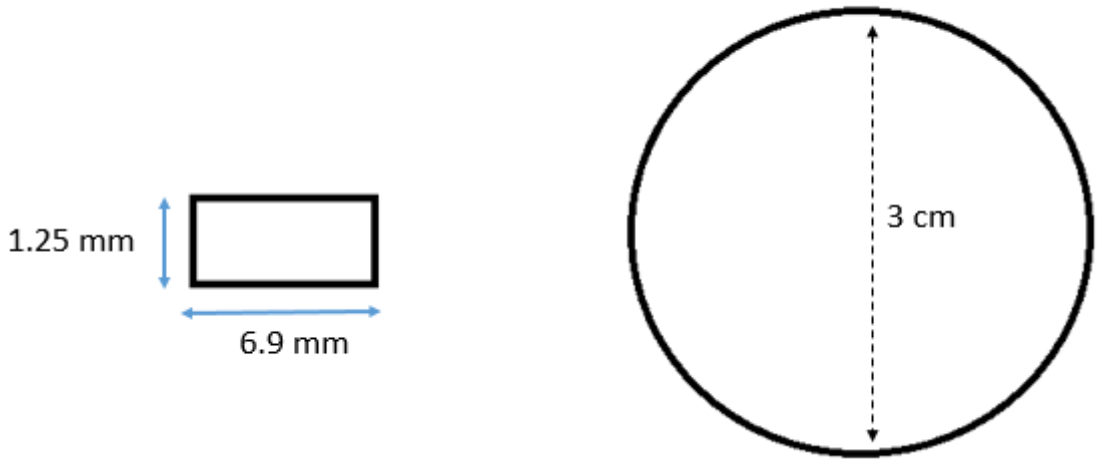

Figure 2

The obtained design parameters are as follows;

N_1	1725	
N_2	20	
B	1.5T	
Copper mass	326 kg	
Core mass	3.7 ton	
R_1	4ohm	
R_2	0.53 mohm	
L_m	50 H ????	N_1^2/R ???
P_{core}	9.4 kW	
P_{copper}	5.3 kW	
Efficiency	98.3%	

The core mass is still high, the turn numbers can be chosen higher. But when the turn numbers are too high the core needs to be very long to be tall enough for the coils to fit. I think L_m turned out to be too large, there must be something wrong. Maybe the reluctance calculation is wrong.