Chad Meadowcroft
2016

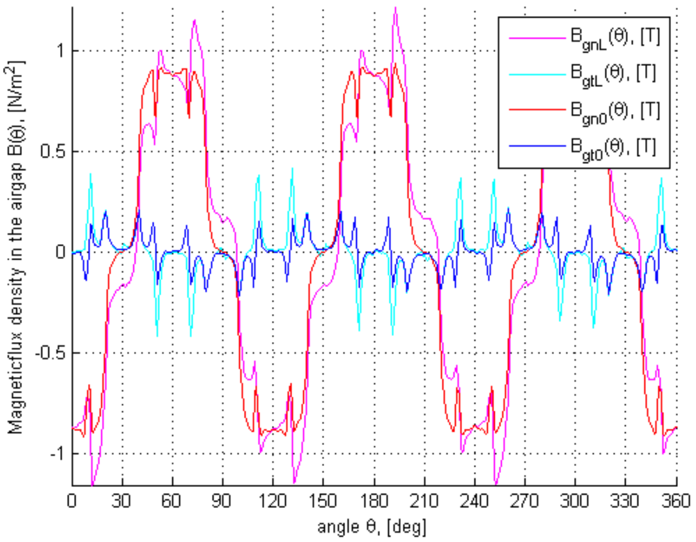
EIEN20 Assignment 4

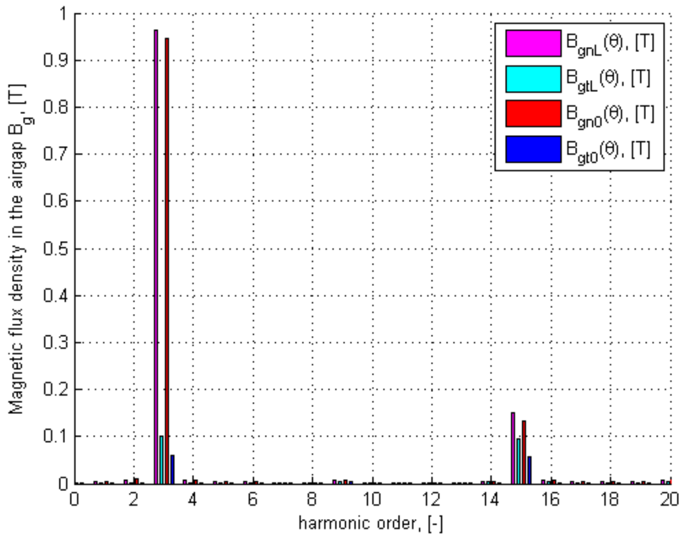
Introduction

I will be using the same parameters as from assignment 3, simulation 4:

Motor frame size	*Outer/Inner diameter Do/Di [mm]*	*Stack length lr [mm]*	*No. of poles N_p*	*Slotting factor K_s*	*Stator core inner radius [m]*
115	105/25	50	6	0.3	ro-(ro-ri)*0.7

1.)

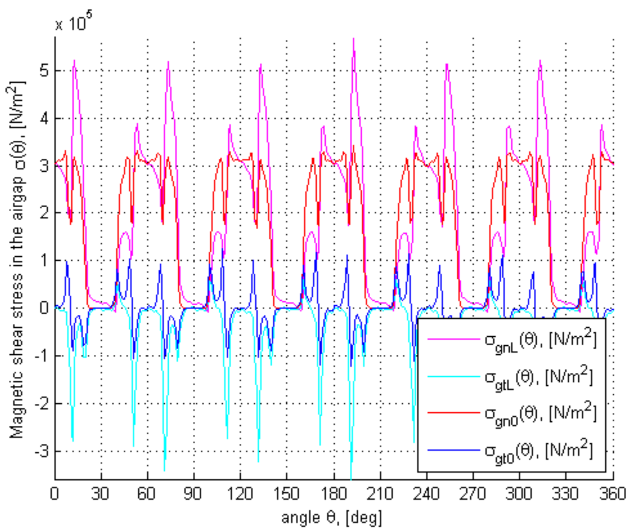


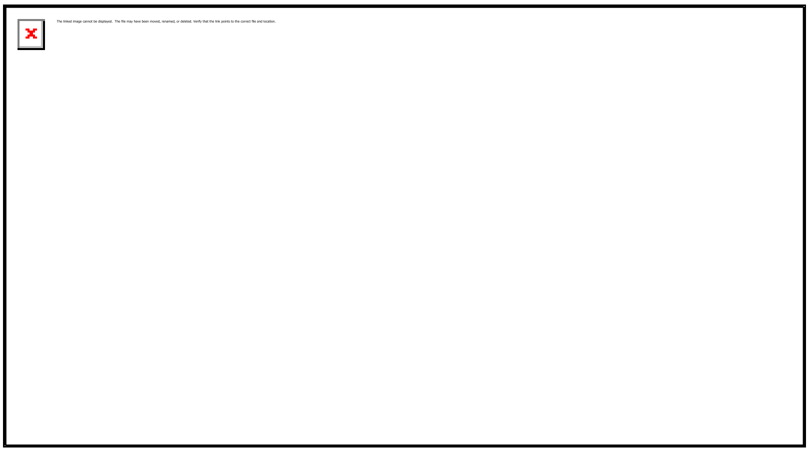


These graphs generated by Matlab show that the normal gap flux density BgnL & Bgn0 is larger and in the opposite direction to the tangential flux density BgtL & Bgt0.
The peak gap density is around 1.2 T, which occurs at a harmonic order of 3. This corresponds to the peak gap flux density for this motor from assignment 3 of 0.8919 T. There are differences here because of the calculation method.

2.)

This graph of air gap magnetic sheer stress gives 4 separate outcomes. σgnL & σgn0 represent tensile or 'normal' stress. σgtL & σgt0 represent the shear stress that is experiences at parallel to the rotor. From intuition we can tell that the loaded motor will have higher stress forces acting upon it. Therefore I conclude that σgnL & σgtL are the tensile and shear stresses for the loaded motor and σgn0 & σgt0 are unloaded.





This gives us a peak torque value for the peak shear stress value used when motor is loaded. The unloaded torque is 293.54Nm.

3.)

From Matlab:

Weighted Torque=6.81Nm

Integrated line Torque at r=0.0241Nm

Integrated line Torque at m=-6.97Nm

Expected Torque from A3=6.797Nm

The torque values from A3 and A4 are close, small differences can be attributed to calculation method etc. An interesting observation is that the integrated line torque in negative, this could be due to the symmetry of the line.

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5.)

Loaded flux linkage:

12.933*10^-4Wb (I)

3.950*10^-4Wb

2.835*10^-4Wb (I)

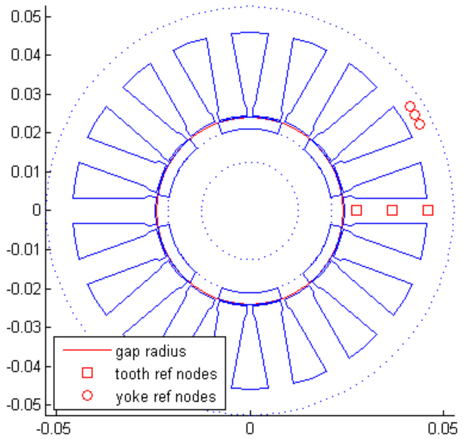
Unloaded flux linkage:

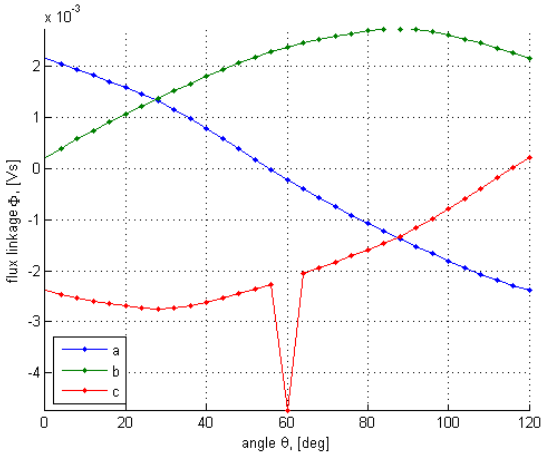
9.230*10^-4Wb R)

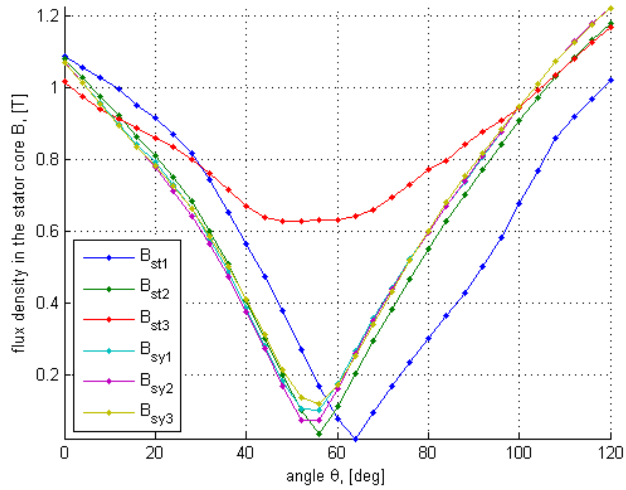
Loaded current:

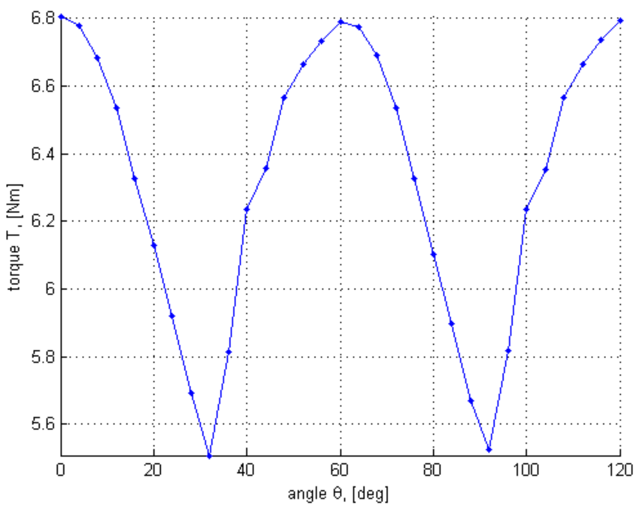
940.5A (I)

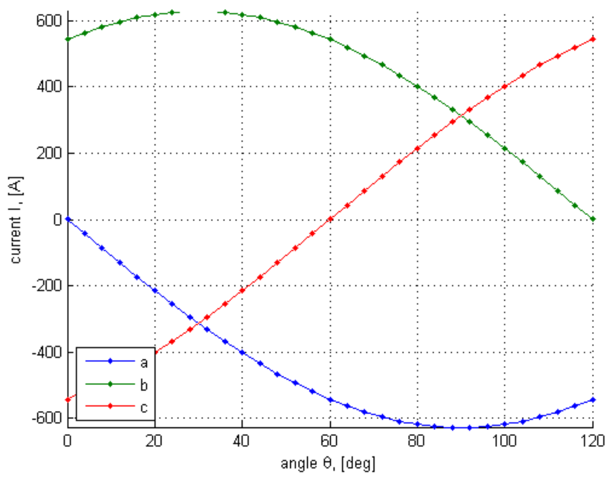
-1A (R)





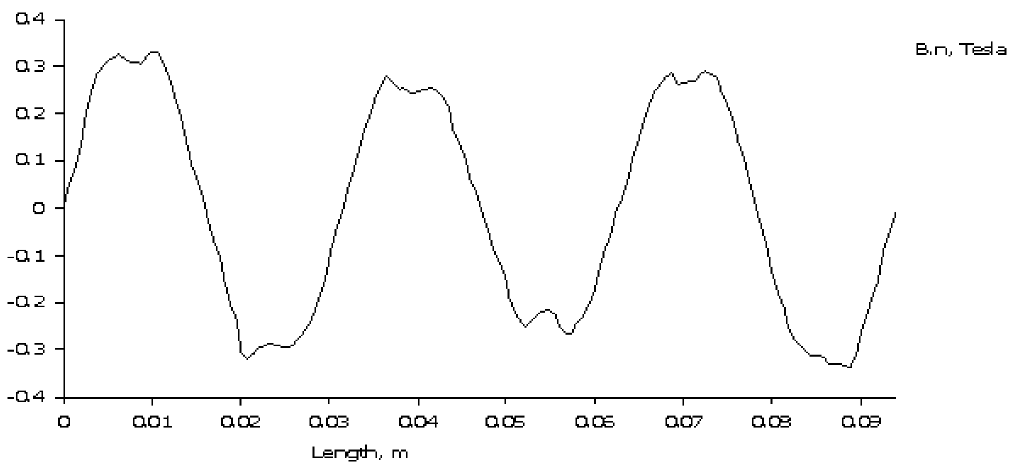






4.3 - Femm hands on

7.)



10.)
At section 8, when modifying the winding currents the values that were present were the same as before but all moved to a new winding. For these winding currents the torque was 0.021045Nm.
I changed the currents back to the same windings as in the previous excersize and the torque was then 4.42922Nm.

The previous weighted torque value from Matlab is -6.97Nm, this roughly corresponds to my second result.

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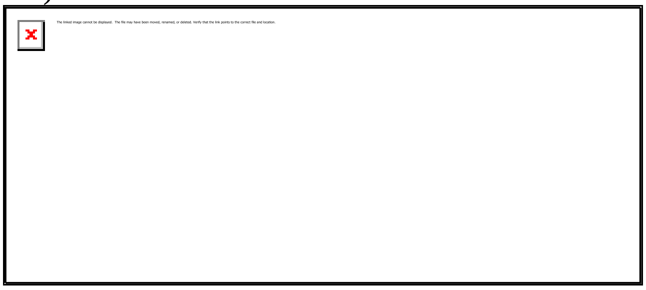
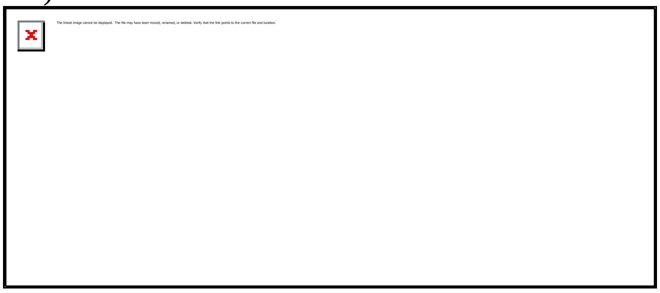
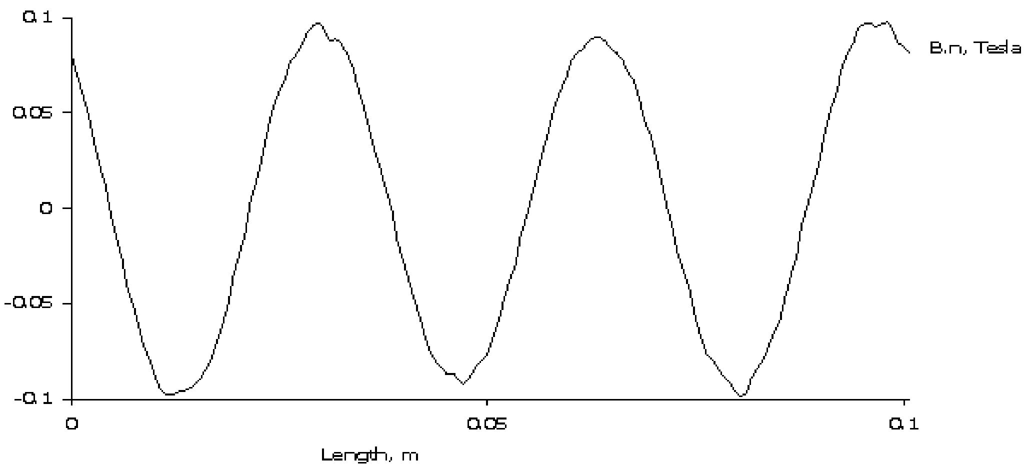
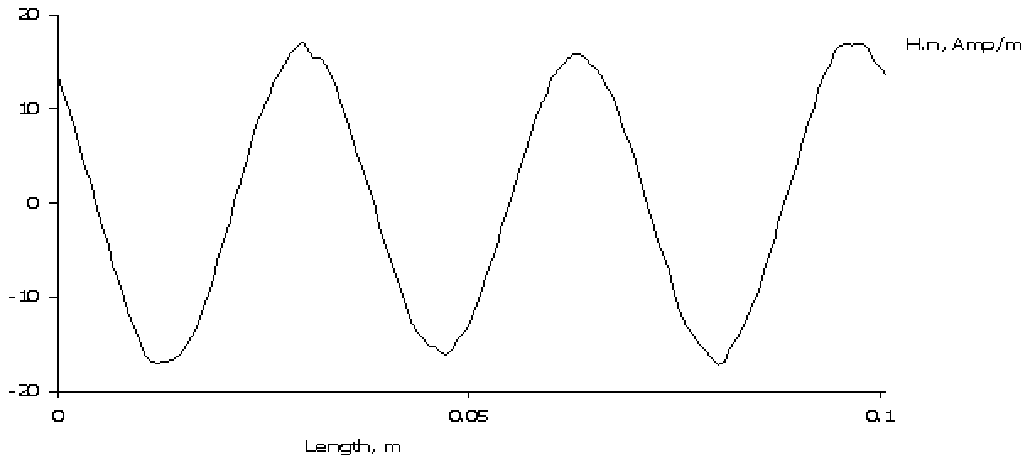
11.)



14.)







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Additions/Improvements

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