Fall 2005 EE595S
Homework Assignment Number 3

Note: Since this will not be collected, there is no due date. It is recommended that this be completed before we start the next set of lecture notes.

Problem 1

The turns density of a PMSM is given by $n_{as}(\phi_{sm}) = 162\sin(2\phi_{sm}) - 86.6\sin(6\phi_{sm})$. How many poles does the machine have ? What is the winding function ? (Note: this is the machine that you will be working with in the lab)

Problem 2

Starting with (2.2-19) derive (2.2-24), (2.2-28), (2.2-31), and (2.2-32). Note: there is a error in at least one of these equations in the notes.

Problem 3

Consider the example whose results are in Figure 2.4-1 of Chapter 2 of "Analysis and Design of Permanent Magnet Synchronous Machines". Repeat this example if $L_d = 8$ mH and $L_q = 16$ mH.

Problem 4

Referring to Chapter 2 of "Analysis and Design of Permanent Magnet Synchronous Machines", suppose the machine is configured as in Fig. 2.5-1. The impedance measured by the LCR meter is 2.5+j10 at 60 Hz. What is L_d ?

Problem 5

Referring to Chapter 2 of "Analysis and Design of Permanent Magnet Synchronous Machines", suppose the machine is configured as in Fig. 2.5-1. Could this configuration be used to measure the q-axis parameters ? If so, what would you have to do ?

Problem 6

The a- to c-phase open circuit voltage of a PMSM is given by $v_{acs} = 200\cos(250t + 0.1)$. Compute λ_m.

Problem 7

Enumerate the sequence of calculations needed to simulate a PMSM, starting with v_{ag}, v_{bg}, and v_{cg} and ending with the time derivatives of the q- and d-axis currents.