EE155/255 F17 Homework 6 Magnetics

Assigned 10/30/17
Due 11/6/17

For both problems, assume a material with a core loss given by

$P_c = af^cB^d$

Where loss is 80kW/m^3 at B=0.1T, f=100kHz, the exponent of frequency is c=1.6 and the exponent for B is d=2.5.

Problem 1 – Inductor Design

Design a 5.6μH inductor that must handle a maximum 10A *average* current with a 10% ripple (current is a triangle wave from 9.5A to 10.5A) at 100kHz. Your total power dissipation (core and copper losses) must be less than 2W. Use the smallest E core (by volume) in the Ferroxcube catalog that meets this specification. Use 30AWG magnet wire and assume that there is no appreciable increase in resistance due to skin effect or proximity effect.

http://www.ferroxcube.com/FerroxcubeCorporateReception/datasheet/FXC_HB2013.pdf

Problem 2 – Transformer Design

Design a transformer for a bridge converter with a primary winding that handles 48V at 10A, and a secondary 24V at 20A, average duty factor 50%, 100kHz operation, 2.5μs average pulse width). There are no constraints on the magnitude of the magnetizing inductance or current. The power dissipation of your transformer (core and copper losses) must be less than 10W. As with Problem 1, use the smallest E core (by volume) in the Ferroxcube catalog that meets this specification. Use 30AWG magnet wire and assume that there is no appreciable increase in resistance due to skin effect or proximity effect.