Lab 2 Control of inductive load.

Aim of lab:

After this lab you should be able to take care about problems that will occur with PWM control of inductive load. You should aswell understand how you can connect drivers to your microcontroller.

Exercise:

1. Start with picking up a coil and measure the resistance and inductance. Measure with and without iron core. Use the core in the following experiments.

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2. Connect a coil to your transistor. Control it with a 50% duty cycle and 6 kHz frequency. This will preferably be done from the Embed controller. Measure, with oscilloscope, the voltage V_{DS} over the transistor. How does the voltage look like and what levels do you get? Are you using a diode or not?

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3. If you do not have a diode put one in parallel with the coil.

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4. Vary the PWM dutycycle, use two different switching frequencies, approximately 20 Hz and 20 kHz. Can you get different forces from the core? Why are you getting it or not?

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5. Change direction of the connection to the coil so the current will have the opposite direction trough the coil. What can you notice? You should have a plunger inside the coil.

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6. If you place the diode at coil or at the board, what differences would that give you? What could the differences be for radiated emissions?

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7. Change to your motordriver circuit. Connect your PWM signal to the Phase pin. Connect the enable and mode pin appropriate. Use 1 kHz as switch frequency. What value have you chosen as current limiter?

8. Control motor 1 with the H-bridge. Motor 2 should be used as a generator. Put a power resistor to get reed of the energy between the two (motor 2) connectors. Use the same connection as in 7 for the control pins. Measure the current trough the load. Do this over the R_s. You can try different dutycycles. How does the current look like for different directions 25 and 75 % dutycycle?

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9. Use 1 kHz frequency and 50% dutycycle. Look at the current trough the motor by measuring the voltage drop over R_s. What peak to peak value do you get for the current? Is the motor getting hot?

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10. What inductance and resistance has your motor? What τ do your motor have? Compare that to your cycletime divided by 2. Comments? Chose a PWM frequency that you think will work. What peak to peak value do you get now at 50% dutycycle?

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11. Make same measurements as in 8 (25 and 75 % duty) with your new frequency, compare the results.

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12. Back to the solenoid. Can you think of any way to get a faster response from it?

Extra, if you have time and are not exhausted:

Use the mode pin and change between fast and slow current decay mode. Measure the current, what differences do you get.

Ready!