Fundamentals of Power Electronics
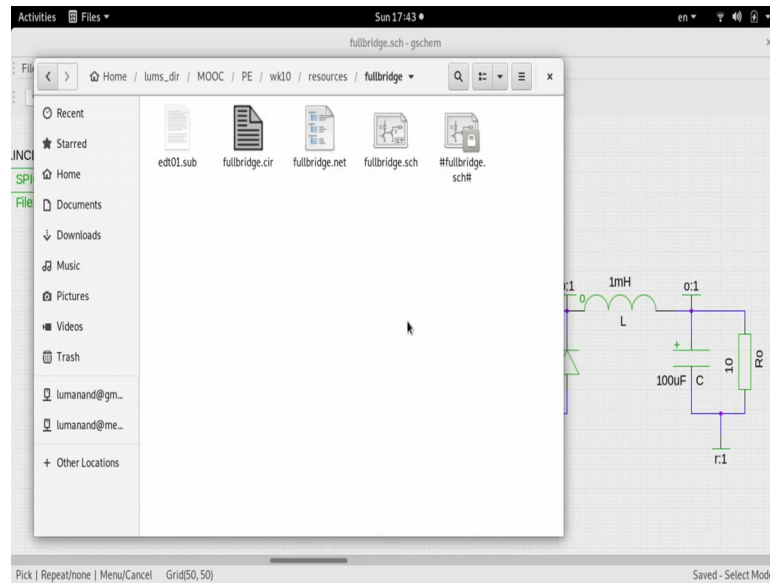**Prof. L. Umanand**
Department of Electronics Systems Engineering
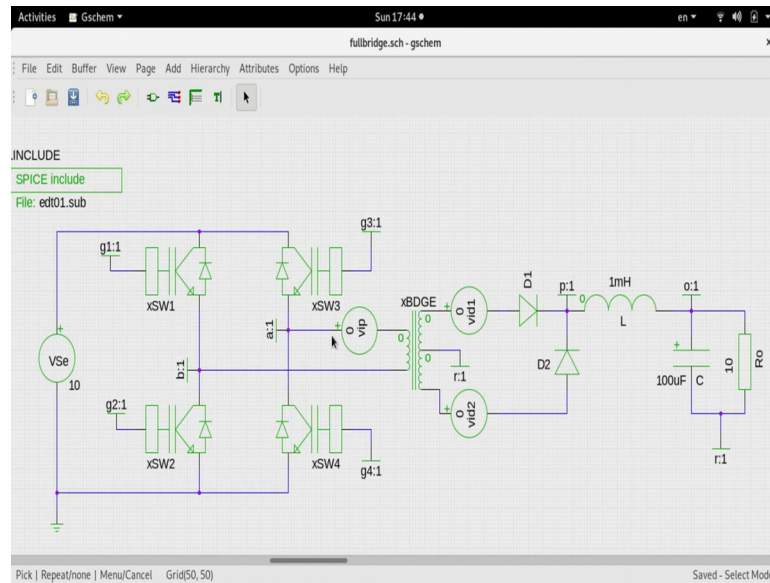**Indian Institute of Science, Bengaluru**

Lecture – 78
Stimulation of fullbridge convertor

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Let us now do a simulation for the full bridge converter circuit. I have within the resources folder a folder on full bridge and within that you have the full bridge schematic, netlist cir file and the sub circuit model files.
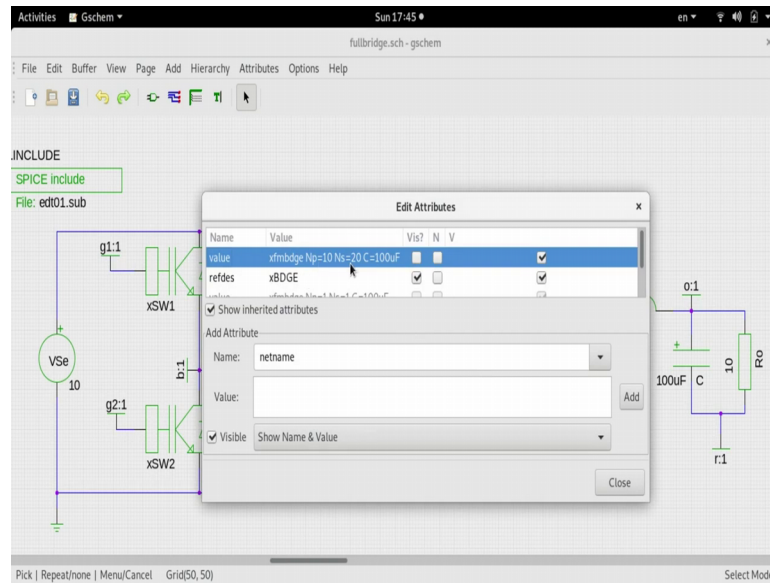
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So, when you open the full bridge dot schematic it look something like this. You have a full bridge circuit diagram here as we have discussed switch q1 q2 q3 q4, and they are driven by gate drive signals g1 g2 g3 g4. So, these two are mutually exclusive, these two are mutually exclusive, these two are switched together. And g2 and g3 are switched together. So, you can observe the wave forms at a and b and across a b.

So, I have here like in the half bridge and the push pull a current sensor a 0 voltage element put as a current sensor. On the secondary side of the bridge centre tap bridge you have a 0 voltage current sensors to sense the id 1 and id 2. The centre tap is the reference node point, and from the pool you have the inductance and then the output with the C filter and R naught; so, this is your full bridge circuit.

You see that I have ten turns in the primary twenty turns on the secondary turns ratio 2. So, you will get v pole, here it is 10, so, you have 10 volts at the primary 20 volts for p. But you will have the diode drops and the on state drops of the switches, there are two on state drops.

So, you will have one on state drop for switch 1 another on state drop for switch the other switch which is 4 which will come into picture, then you have the diode drop. So, you probably will land up with around with 3 to 3.5 volts overall. So, you may have some 16 volts pole voltage. Then the duty cycle and output voltage comes in here.
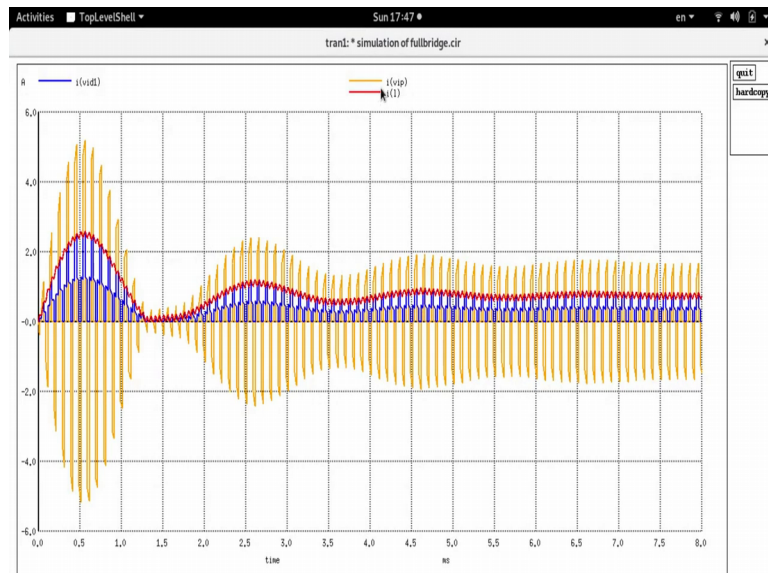
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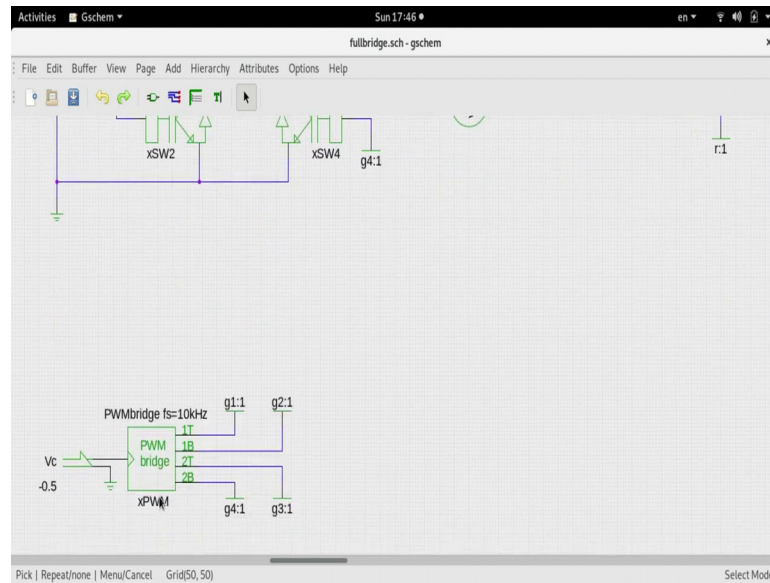
And if you look go down here you I am using the same PWM bridge, the first arm top switch drive this is g 1, first arm bottom bridge drive it is g 2, second arm top switch drive g 3 and g 4. And always remember that g 1 and g 4 are switch 1 and switch 4 are switched on simultaneously cross. And switch 2 and switch 3 are switched on simultaneously and in a mutually exclusive manner. Now, let us simulate the circuit and then see we will go to the terminal and run the simulation in ng spice.

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So, I am in the terminal, I am in the folder full bridge, so, let me run the net list. Let us generate the net list from the schematic. So, you have the net list generated, now run ng spice from the cir file I have used similar cir file like I used for half bridge and push pull circuit.

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So, on running you get the waveforms like this. As before, I have measured the current through the inductance, output inductance, current through the diode d 1 and current through the primary.

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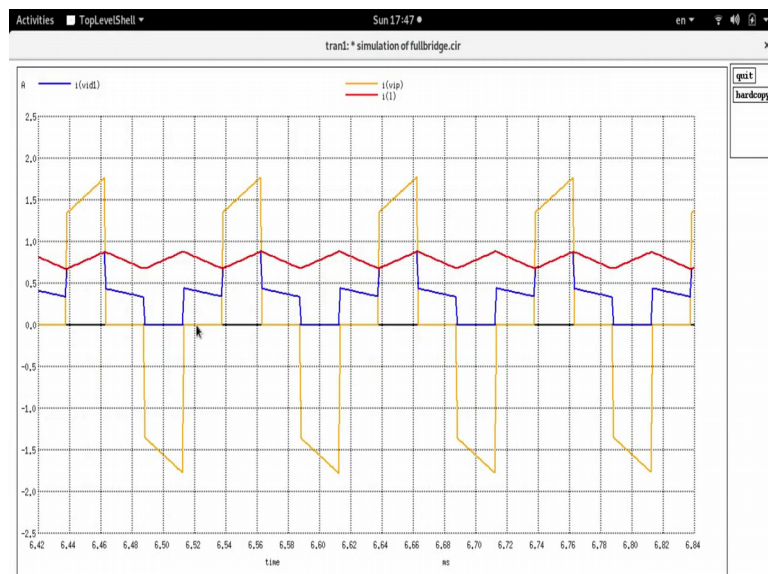
So, if you if I zoom in and look at that, you will see that bit more clearly, the red wave shape is the current through the inductance going up and down at twice the frequency a the switching frequency. The blue wave shape is the current through the diode, see that it follows the indictor and then doing the freewheeling time. It takes only half the current the remaining current flows through the other diode.

And the orange waveform here is the primary current waveform which is reflected on to the primary of the full bridge circuit. Let me plot v a b, v a b is the voltage across the bridge. So, this will give you the voltage across the primary, and let us see how it looks like.

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So, if you plot that voltage and let me take a small portion of that, if you see that, you see that the voltage when one set of switches are on you will see the primary dot end positive. And it is v d c minus the saturation drops of 2 switches.

And then when the non dot end is positive, you have not again the on the other side the primary voltage these two should balance each other. And during this time during the time when all 4 switches are off you will see observe that there is no induced voltage across the coil the primary voltages are 0.

So, this is typically the type of operation that we expected. And I will leave it to you to explore this full bridge circuit change the values and try to learn as much as you can from this simulation.