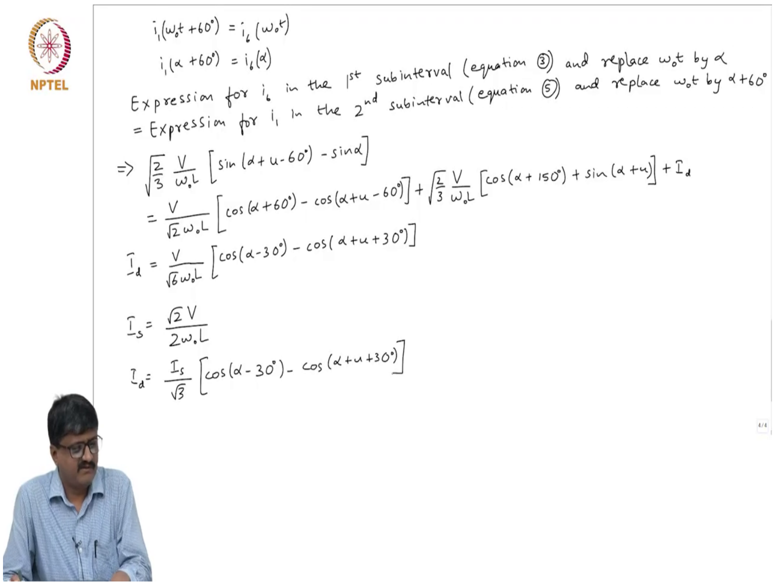
**DC Power Transmission Systems**
**Prof. Krishna S**
**Department of Electrical Engineering**
**Indian Institute of Technology, Madras**

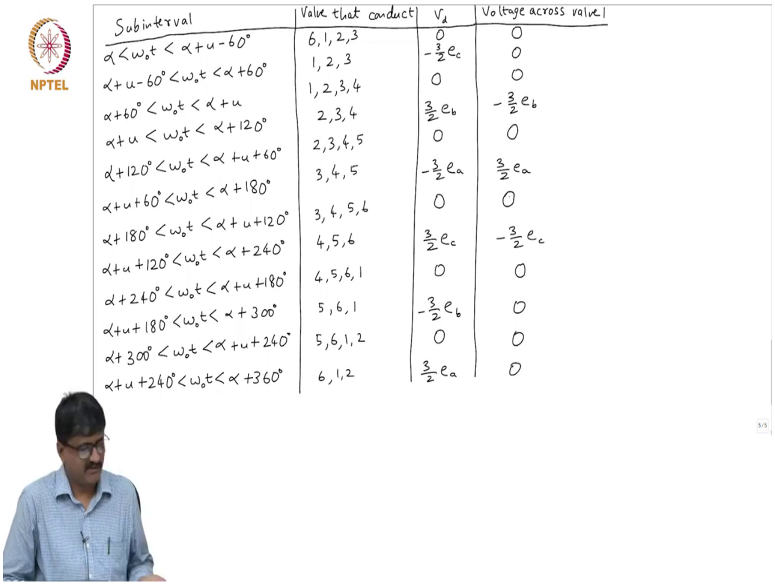
**Lecture - 30**
**Analysis of 3 and 4 valve conduction mode of 6 pulse LCC: Part 2**

(Refer Slide Time: 00:16)




Now, what we will do is we will form a table as we did for the previous cases and try to see what is the voltage across valve 1, what is the voltage across this DC set terminals.

(Refer Slide Time: 00:34)




So, I need to consider all the subintervals and in each cycle there are 6 intervals and in each interval there are 2 subintervals. So, so there are 12 subintervals in one cycle. So, I have to consider all the subintervals. The first subinterval is always starting at alpha.

So, omega o t between alpha and alpha plus u minus 60 degrees. The second subinterval is alpha plus u minus 60 degrees to alpha plus 60 degrees; alpha plus 60 to alpha plus u. The third subinterval which stops at alpha plus u. So, how to get that? Go to steps backward at 60 degrees that is all.

So, once you know what is the first subinterval in the second subinterval, once you know first subinterval you know, the second subinterval the end of the second subinterval is a the beginning of the first subinterval plus 60 degrees ok. So, if you want to just write any row go back 2 steps backward and add.

Student: 60.

60, that is all. So, alpha plus u to alpha plus 120 alpha plus 120 to alpha plus u plus 60 degrees, alpha plus u plus 60 degrees to alpha plus 180, alpha plus 180 degrees to alpha plus u plus 120 degrees, alpha plus u plus 120 degrees to alpha plus 240 degrees, alpha plus 240 degrees to alpha plus u plus 180 degrees, alpha plus u plus 180 degrees to alpha plus 300 degrees, alpha plus 300 degrees to alpha plus u plus 240 degrees, alpha plus u plus 240 degrees to alpha plus 360 degrees.

So, that completes one cycle. So, if I look at the valves that conduct; valves that conduct in each subinterval, so, how many valves conduct in the first subinterval? 4 valves; 6, 1, 2, 3, at the end of first subinterval 6 tops conducting. So, the valves that conducting in second subinterval are 1, 2, 3. So, again in the third subinterval 6 valves conduct sorry 4 valves conduct, 1, 2, 3 4, and 2, 3 4, then 2, 3, 4, 5, 3, 4, 5, 3, 4, 5 6, 4, 5, 6 4, 5, 6, 1, 5, 6, 1, 5, 6, 1, 2, 6, 1, 2 and then the cycle repeats.

If I look at the DC side instantaneous voltage V d, now it is easy to say what is the expression for V d whenever 4 valves conducted. So, whenever 4 valves conducted it means the only 3 legs at least in one leg both valves conduct; so, V d is 0. So, whenever 4 valves are conducting on all the subintervals it is 0. Now, in the second subinterval valves 1, 2, 1, 3 conduct, what is V d?

Student: Minus (Refer Time: 05:45)

Yeah, we have derived this is for 2 and 3 valve conduction mode. So, the expression for V d is just dependent on which valves are conducting that is all. So, it is minus 3 by 2 e c. So, we have derived this, this is 3 by 2 e b minus 3 by 2 e a 3 by 2 e c minus 3 by 2 e b and 3 by 2 e a.

So, if I look at voltage across valve 1, so, what is the voltage across valve 1 in the first subinterval? Sorry?

Student: 0

0; say whenever valve 1 is conducting it is 0. So, in the first subinterval valve 1 is conducting. So, it is not just first subinterval, in all the subintervals where valve 1 is conducting it is 0; second subinterval valve 1 is conducting; third subinterval valve 1 is conducting. So, I will just fill the rows where valve 1 is conducting ok.. What about the subinterval in which valves 2, 3 and 4 are conducting? It is equal to we showed that it is equal to minus?

Student: (Refer Time: 07:30).

V d; so; that means, this is minus 3 by 2 e b. We also have the result for the subinterval when valves 3, 4 and 5 are conducting, it is equal to minus V d. So, this is 3 by 2 ea and we also have the results. See this is from the previous table that is all. So, when 4, 5 and 6 are conducting where voltage across the r 1 is minus V d. So, this is minus 3 by 2 e c ok.

Now let us come to the case where valves 2, 3, 4 and 5 are conducting. What is the voltage across valve 1 when valves 2, 3, 4 and 5 are conducting?

Student: (Refer Time: 08:23).

2 and 5; yeah when 2 and 5 I mean at the DC side voltage is 0. I mean what is what about voltage across valve 1? V d is 0, of course, V d is 0. The question is what is the voltage across valve 1? Yeah. If it is 0 why it is 0?

Student: (Refer Time: 09:03).

Yeah.

Student: (Refer Time: 09:05).

4?

Student: (Refer Time: 09:07).

4 is conducting; see valves 1, 4 5 and 2 form a?

Student: (Refer Time: 09:12).

Form a loop. So, you will see that valves 1 4, 5 and 2 form a loop. So, when valves 4,2 and 5 are conducting; 4,2 and 5 are conducting then what is the voltage across valve 1? It is 0; Kirchhoff's voltage law nothing more than that ok. So, the point is you look at the loop consisting of valves one 4, 2, 1, 5. So, when 3 of the is 4 valves conduct voltage across the other valve should be 0. So, this is 0 ok, then when 3, 4, 5 and 6 conduct?

Student: Same.

Same. Now, look at the loop consisting of the valves 1, 3, 6 and 4. So, 3, 6 and 4 are conducting. So, by Kirchhoff's voltage law voltage across valve 1 is 0 ok. So, I will stop here.