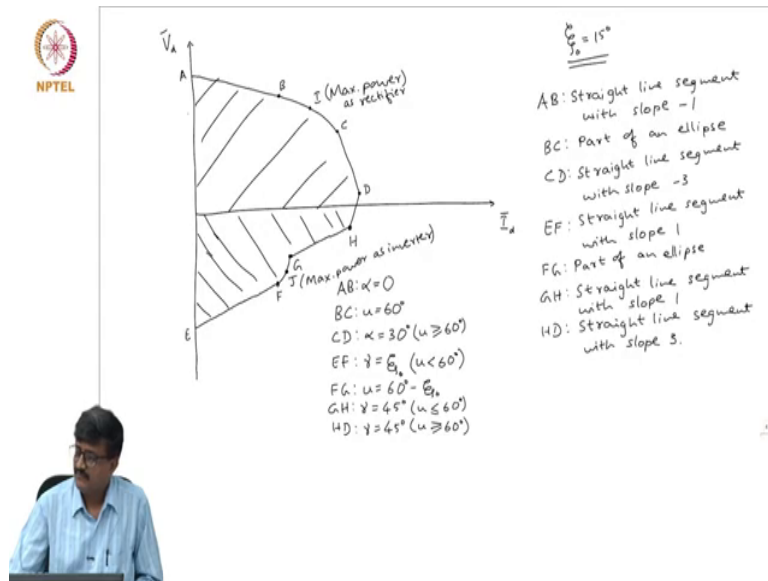**DC Power Transmission Systems**
Prof. Krishna S
Department of Electrical Engineering
Indian Institute of Technology, Madras

Lecture – 36
Characteristics of 6 pulse LCC: Part 2

(Refer Slide Time: 00:18)

We get a boundary of operation like this so; I will not show the second quadrant and the third quadrant, I will just show the first and fourth quadrant. So, I have V d I have I d. So, what you need to do for getting the characteristics assume some value of psi naught. So, I would suggest take the value of psi naught as 15 degrees.

Mark some points A B C D E F G H. So, here A B is a straight line segment with slope minus 1, then BC is a part of and ellipse, CD is a straight line segment with slope minus 3 and EF is a straight line segment with slope plus 1 and FG is part of an ellipse, GH is another straight line

segment with slope 1 and HD is straight line segment with slope 3. So, what I am trying to say is I am trying to show this boundary of region of operation.

So, the operation is restricted to this region in the first and fourth quadrants if I choose the value of a psi naught as 15 degrees. So, I take the value of psi naught as 15 degrees and get this region. So, essentially this A B I mean, I should be able to guess what is A B? Then AB is corresponding to constant alpha, constant gamma, constant u. Constant alpha. So, it is corresponding to one particular value of alpha will you guess what will be the value of alpha of say, see this A B C D E F G H is a curve which gives the boundary of operation. Operation is not possible beyond this so, what are I am writes?

Student: (Refer Time: 04:49).

This is the region of operation which is possible done. Alpha is?

Student: (Refer Time: 04:55).

0. So, it actually corresponds to alpha equal to 0, then if I take, BC it may not be very obvious why what is this correspond, I will give the answer u equal to 60 degrees, its part of an ellipse, ellipse corresponding to v equal to 60 degrees. Then if you take CD so, this is constant alpha or constant gamma, constant u constant?

Student: Gamma.

Gamma, so, in constant gamma will always use positive slope. Whether, it is 2 and 3 valve conduction mode or 3 and 4 valves. So, this is constant alpha and this corresponds to alpha equal to 30 degrees. So here, u is greater than or equal to 60 degrees see I did not say what is the value of u for AB is at obvious, what is a value of u for I mean, what is the range of u for AD line AD since, alpha is 0 it cannot be greater than; u cannot be greater than?

Student: 60 degree.

60 degree. So, u is less than 60 degrees for AB. Then if I take the straight line segment EF so, EF is a straight line segment with positive slopes so, it corresponds to constant?

Student: Gamma.

Gamma. So, it actually corresponds to gamma equal to psi naught, it is I have taken value as I mean, which I have taken to be equal to 50. So, this is for u less than 60 degrees then it should take FG. So, I have said FG is an ellipse so; that means, if corresponds to constant u. So, this corresponds to u equal to 60 minus psi naught, then GH is again a straight line with a slope 1.

So, it corresponds to constant gamma. So, it actually is corresponded to alpha, gamma equal to 45 degrees and u is less than or equal to 60 degrees. And finally, HD see whenever the slope of the straight line segment is 1 or minus 1, it corresponds to constant gamma or constant alpha a value of u is less than or equal to 60, whenever the slope of the straight line segment is plus 3 or minus 3, it is plus 3 for constant gamma and minus 3 for constant alpha, u is greater than 60 degrees.

So, HD corresponds to gamma equal to 45 degrees, but u is greater than or equal to 60 degrees. Now, if I want the point if see, what is the first quadrant? First quadrant corresponds to positive V d; that means, rectifier operation. So, if I take rectifier operation then which point corresponds to maximum power? I mean its where it is not which point can I have a restrict myself will some region say let me take this region ok. So, this is rectifier allowed rectifier region. So, if I want the point of maximum power exact point may not be easy, but when I say that it lies on some curve which person.

Student: ABC.

It lies on ABCD curve. So, it can be shown that I will leave it to you to prove that it lies on the BC curve. So, there is one point on the BC curve suppose I call this as I. So, prove that the maximum power. So, this I corresponds to maximum power as rectifier. So, I will leave it

to you to prove that see what you will need to do is along AB try to see, what is if I take along AB then can I say which point is correspond to the maximum power along AB.

Student: If (Refer Time: 09:42) BC maximum power (Refer Time: 09:44).

Yeah.

Student: Maximum power.

50. See if I already given the answer as some BC along AB it is B. So, since the answer is along BC if you take CD along CD it is C.

Student: C.

Along CD it is so, but you know one has to prove that. Similarly, if I take inverter operation so, inverter operation is corresponding to this region in the fourth quadrant. So, in the fourth quadrant again the maximum power point has to lie on this curve EFGH ok. So, again one can show that it lies on this curve FG suppose I call it as J. So, this corresponds to maximum power as inverter. So, a please note the two are different this is maximum power as rectifier when operating as rectifier whereas, this is maximum power as inverter. So, what I would suggest is you take all this I am mention so many points here A B C D up to J ok.

Point	α	γ	u	$\frac{?}{I_d}$	V_d
A					
B					
C					
D					
I					
E					
F					
G					
H					
J					

So, you take all these points if I take point A B C D, A B C and D corresponds to rectifier operation, I also corresponds to rectifier operation, I is correspond to maximum power as rectifier. Then E F G H these are all in E F G H all I in the fourth quadrant. So, they correspond to inverter operation J is also inverter operation. So, what I will suggest is try to get the values of alpha, gamma, u I d and V d for this points ok. So, fill this table let us essentially filling this table.