Indian Institute of Science
Design of Photovoltaic Systems

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NPTEL Online Certification Course

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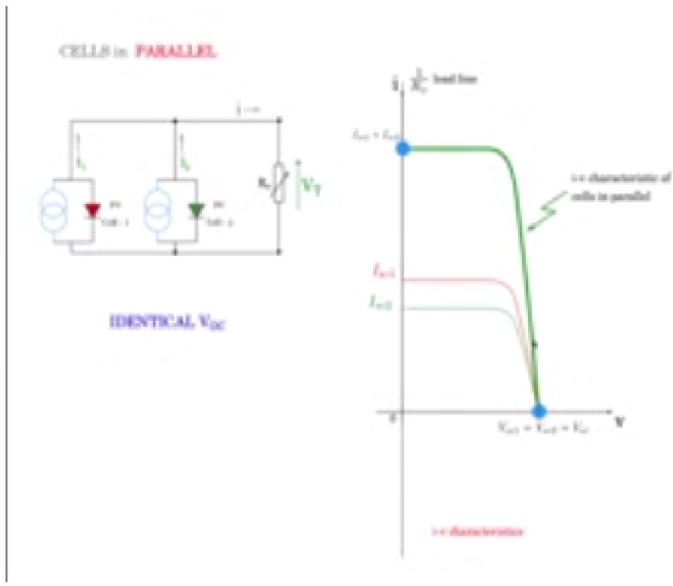

Consider the case here where to the cells A and PV cell one and PV cell 2 have characteristic as shown here there are non identical characteristics however the V_{OC} point is identical traveling these types of cells will also lead to a exactly same in the nature of the resulting iV characteristic as we saw for identical cells being parallel, if you consider the case when the load R0 is short circuited then the load line is the vertical axis x axis the operating point is nothing but addition of these two currents ISC1 and ISC2.

So ISC becomes ISC1 ISC2 the other operating point of course is VOC these being parallel $V_{OC1} = V_{OC2} = V_{OC}$ any other operating point can be obtained by changing the load putting in some finite value of the resistance and the load line and the voltage developed across the panels we defined this oprteating point, so i1 + i2 will be the height of this and the voltage developed across the load will be this great and so on if you sweep this load line you will land of with this time of iV curve.

For the combined system having non identical characteristic but identical VOC point so you see that this is going similar to the iV characteristic of the identical cells in parallel.

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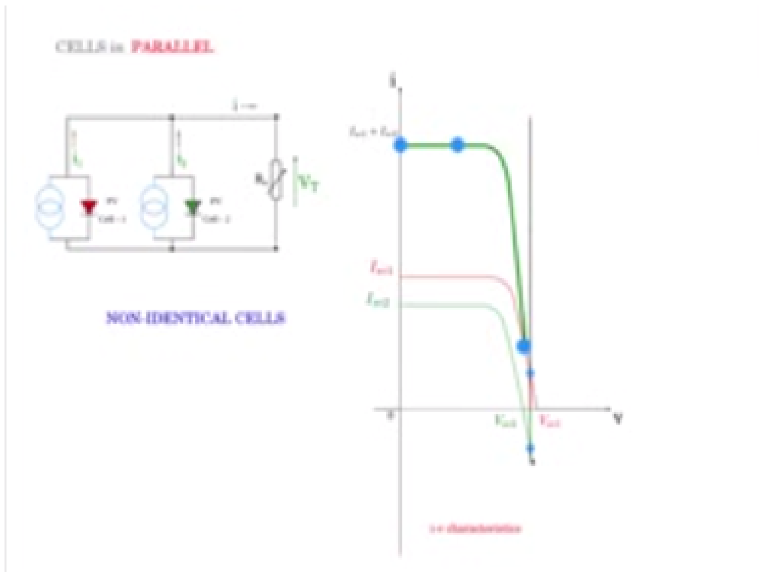

Now let us consider cells that are total in non identical both the short circuit points and the VOC points are different for both the cells and let us see how to derive the overall characteristics iV characteristics of the cells and parallel non identical cells in parallel, ISC1 and ISC2 or the short circuit parameters for the to cells and V_{OC1} and V_{OC2} are the open circuit voltage parameters so that two cells respectively, now consider in a situation where R_0 is 0 that is the external terminals of the parallel combination system.

The short circuited the load line id vertical and then we can get a one operating point of the result and iV characteristic which is the ∑ of these two values, which is ISC1 + ISC2 now let us introduce some resistance R0 the load line is like this it has a finite resistance value and therefore a finite slope, now obtaining this operating point that is well known and we have seen that even the other cases we have the corresponding currents and this point I1 + I2 this is the current value and we did the voltage while you which is occurring across the parallel cell combination.

Now let us increase Vt / increasing R_0 such that Vt is exactly = the V_{OC2} value means the open circuit voltage of the PV cell to and this is indicated by this vertical line so I draw this vertical line we just passing through V_{OC2}, you will notice that the cell 2 operating point is here as indicated by the arrow the current I2 is 0 at this point and the entire load current is given by cell so this point here would be the operating point of PV cell 1, and this would also be the operating point of the resultant cell.

Now shifting the load line we really achieve one more operating point for the combined parallel system as shown here, now at this operating point you will see that Vt the terminal voltage is exactly = V_{OC2} that the open circuit voltage of cell2 and at this operating point cell 2 contributes 0 current this will be 0 a current before i will be totally = I1 which will be also in current lowing force a load, notice that this operating point falls exactly on the iV characteristic of the PV cell 1.

This is because I2 = 0 and there is no contribution from cell 2 let us shift the load line further down line for horizontal axis in that case R0 is infinite which means that the terminals or open circuited in that case Vt represents the open circuit voltage of the combined parallel system, I have drawn a line here passing through this point here and this point here pointed by the arrow is the open circuit voltage the combined system at this line just is a marker and this open circuit voltage is in between V_{OC1} and V_{OC2}.

Why should in be so to answer that first let us extend the iV characteristic of the PV cell 2 down below so that it intersects this lines now you see that the iV characteristic of PV cell 2 is in the 4th quadrant this is the 4th quadrant and it is a single quadrant not a source important remember that only the first quadrant is a source important, so now this intersects at this point and we have to marker pints here this small marker here.

Indicates that the PV cell 2 will operate at that operating point and PV cell 1 will operated at this operating point, this current the current here indicated in red and the current here the indicate by green line, will match each other exactly so let me assume this so that you get a better view.

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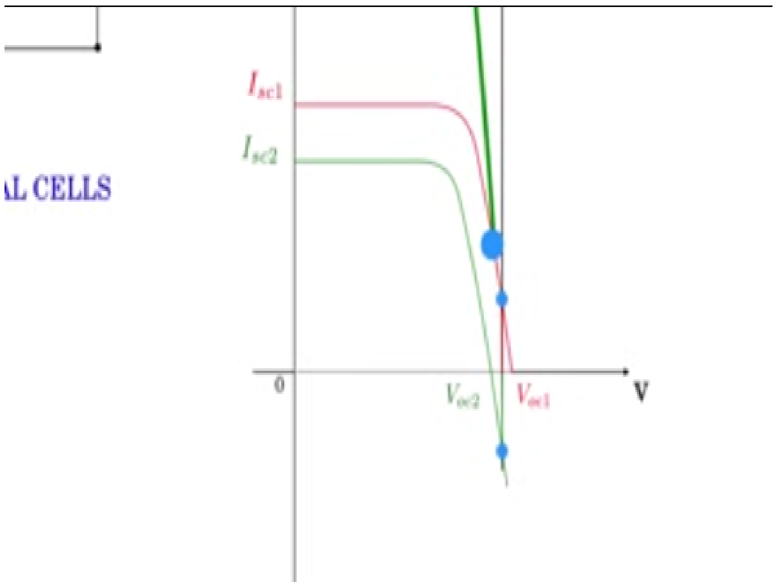

This height here is the current I1 and this height here is the current I2 I1 and I2 will match and cancel each other notice that I1 is still the first quadrant positive for I2 is in the 4th quadrant negative and then I1 and I2 will subtract exactly to 0 and that 0 will be this point, which is the open circuit voltage point of the combined system, with the open circuit point available we can now drag the entire characteristic to get the overall iV characteristics of the parallel system so this would be the open circuit operating point.

And does is be V_{OC} voltage level which occurs in between VO_{C1} and V_{OC2} that this operating point PV cell do is operating the 4th quadrant it is sinking PV cell 1 is always in the first quadrant and the sourcing.