Manufacturing Systems Technology

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Module - 05
Lecture - 30
Manufacturing Systems Technology

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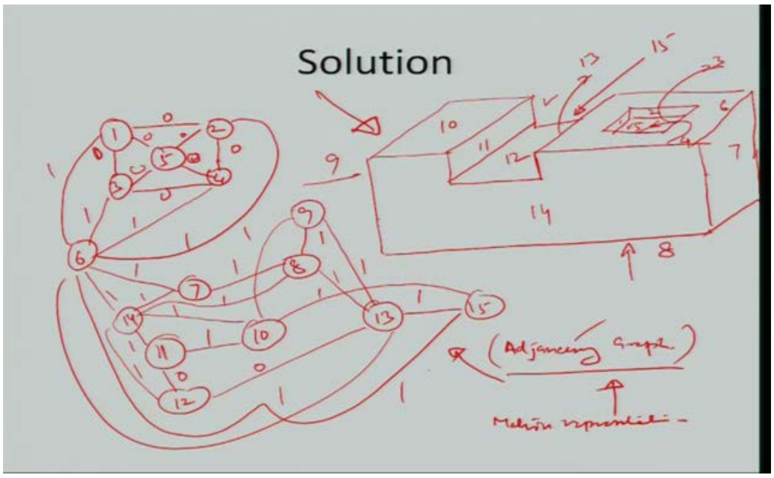

Hello and welcome to this Manufacturing Systems Technology module 30. Brief recap of what we were doing in the last module. We were actually trying to decipher, how to do image feature identification in a complex body which has been mentioned in this particular slide. Here you can see this is that complex shape that is there. So, there is actually looking added from human distant point. It is only there is a slot and then, there is a blinded hole which is there, but how does the computer identify we were trying to do and in that respect, we do the adjacency graph which is shown right here and we were planning to actually now collocate the various attributes which have come as a result of the connectivity between the modes of the surpasses in the adjacency graph onto a matrix form. So, we are going to sort of continue on that, and draw out a matrix here. Obviously, there is going to be above 15 phases.

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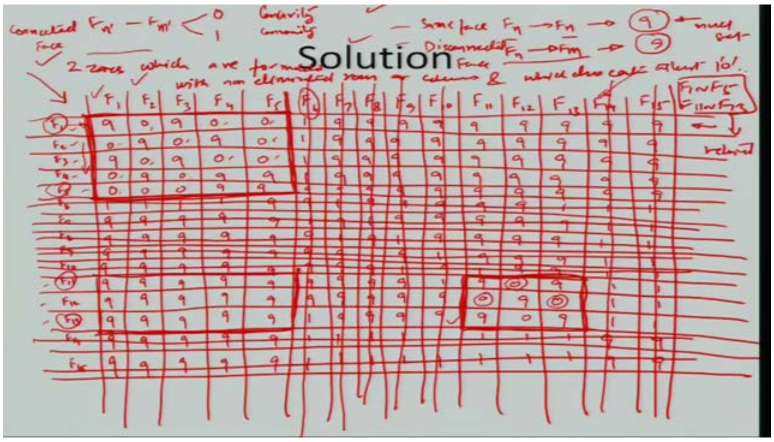

So, let us squall the phases f1 through f15. So, you have f1, f2, f3, f4, f5, f6, f7, f8, f9, f10, 11, 12, 13, 14, 15 and then, we just call the other phases again 15. So, we draw the matrix how does f1, f2, f3, f4, f5, f6, f7, f8, f9, f10, 11, 12, 13, 14, 15. So, this is how the matrix is constructed. I am going to sort of go ahead and split up this matrix as columns and rows. So, there it is easier to understand how you are basically trying to accumulate all the different values. So, you can see the matrix being created here and also divide that into different rows.

So, this is how it is created and now, we want to sort of put all the attributes which we did in the last graph right about here. You can see the attributes between 1 and 2 are so 1 and 5 and so on so forth. So, we want to identify all that from the figure and put this back in this particular value column of the attributes. There are different issues which have to be discussed here. So, for example, if there is a phase let say fn which is having a relationship with the same phase fn. We consider it to be a null set. In this case may be we will just put in a number 9 to represent the null set. There is case where you have a phase f n which is disconnected to the phase f and 9 and 1. So, we will call it null set because it doesn't belong to the family of the arks you know which are being in question and then, obviously if the phase is, so this is case of the same phase.

This is the case of the disconnected phase. So, we don't have edges between these phases and then, there can be another instance. It is fm prime which is connected to fn prime minus 1 or for example, any other phase. So, let us not call it n minus 1 here. Let us call it m just signifying the general notation, so that there is no confusion.

There is absolutely no relationship between n and m. It can be any two phases. So, let us call it n m prime. So, for the connected phases, where the phases are actually let us say we call it connected phases f n dash to f m dash. There are two such relationships which excise if there is a concavity between the connecting phases. We call that rebute 0 and if there is convexity between the connecting phases, we call it attribute 1. So, let us look at now how to fill up this matrix. So, obviously all the diagonal elements here in this matrix would be 9 because essentially it is the same phase connectivity to the particular same phase in question, and the others are again based on the figures.

So, if you look at the figure in the last slide, so between f1 and f2 if we find out the connectivity, so f1 is here and 2 is here. The connectivity is actually 0. So, we want to just fill this f1 f2, connectivity as 0. We don’t really care about this end of the matrix because this actually is going to be symmetric matrix because whatever is a relationship between f1 and f2 as represented here will be the same as between f2 and f1 as represented somewhere here. So, this is all going to be 0. This is actually going to be replicating the values of the attributes if it is f1 to f2 or f2 to f1 connectivity. So, there is absolutely no debate on that and one of the reasons why you can say that the method is going to be good enough to work actually and it is going to have ultimately a symmetric matrix.

So, I am going to write the various relationships here. So, there is no relationship between f1 f3. We call it 9, then 0 here, again 0. At f5 f6 is 1. There is convexity between f1 and f6. Then there is a no relationship between f1 f7 f9. Again 9 here, 9 here, 9 here, 11, 9 here in 12, 9 in 13, 9 in 14 and 9 in 15 and similarly if we will look at, so the other values here, we can have 0 value here between f 2 and f 3. Then you have 9 again between f 2 f4, 0 1 9 9, again 9, again 9, again 9, no connectivity between f2 f11. Similarly, no connectivity between that of 13 and no connectivity between that of you know 2 and 13, again 2 and 12, 2 and 13, 2 and 14 no connectivity, 2 and 15 no connectivity and so on so forth. So, therefore, I just want to fill up all these matrixes in a commensurate manner. Let me just go ahead and do that in the next values of 4, so between f4 again, so f12 again has the relationship with f13 of a concavity. So, putting it 0 1 1, similarly you have 1 and 1 here and then, last bit is 9.

So, you have developed now one side of this matrix just particular end of the matrix based on the various relationships and looking at the figure and looking at the adjacency graph, I am going to just go ahead and completely the other side of matrix just in identical way. So, I am going to copy for example, this particular you know row in the f

1 column because its a square matrix. So, it has repeated values of the relationship which are actually row wise and column wise about the diagonal of the matrix. So, we can call this 0 0 1 9 9, 9 again, 9 again, 9 9 9 9 and 9. Similarly, you can just write down the values here, right here. So, 0 9 0 1 9 9 9 9 9 9 9 9 and 9, similarly you have 0 0 1 and then, you have 9 again and all nines. So, I was just replicating whatever you have in the row wise manner to the column wise and translating from the row wise to the columnar manner or the diagonal element. So, here also is the same. So, you have 9 1 9 9, all nines. Similarly, you have again all the nines together. So, these are all null sets, no connection what so ever. So, you start with 1 9 and have 3 one's.

Similarly, here you start with one diagonal element across the diagonal elements and then, we have five 9s, 1 2 3 4 and 5. Then, you have 1 1. Similarly, you again complete this matrix here, write here in the same manner and then, again the same matrix right about here. Similarly, you have 0 9 1 1 0 1 1 and 1 1 and 9. So, this completes the full matrix solution based on some of the premises which have been mentioned right about here looking at the figure and all looking at the adjacency graph. Now, we have attribute matrix, so all the relation between the different surfaces or different nodes which are existing in the set of arcs are known by the corresponding value of the arks. Obviously, if the same phases to be considered, so it will not belong as there is no connection between the same phase and same phase like an edge. It is very same phase. If it is of phase were it is completely disconnected all. So, you consider that to be a null set. So, null sets is presented by 9 here, number 9 here and then, obviously the connected phases they are either classified as phases set which contains concavity which is represented by 0 or a phase set which contains an edge which is actually convexity which represents the convexity mind you.

This concavity and convexity has to be same from outside the figure projected inward. So, you cannot just consider yourself to be a part of the block while seeing the convexity or concavity, otherwise the values will change from each other. Looking at formal external world into the object and you are trying to gauge whether it is convexity or concavity. So, that is how you assign the value 0 and 1 and that is how you arrive to this matrix. So, once this matrix has been arrived at, what is important here for me to mention is to sort of eliminate those rows and columns which does not contain 0. So, eliminate for example, in this particular case if you look at there is a 0, there is another 0, another

0. So, this is useful row. So, retain that. Whichever has a 0 that row needs to be retained and whichever has no 0, that row needs to be cancelled out. So, for example, this is the row here write about f6, sorry column f6 which doesn't have 0 around. So, I can just simply strike through or cancel this particular row.

Similarly, there is another column f7 here which doesn't have any 0 value. So, I am going to select these rows and cancel it. So, similarly f8, you have f9 canceled, even f10 has canceled, f11 is there is a 0 here. So, I cannot cancel this particular row. You can see that there is a 0 right here, right about here. So, this row is retained. Similarly, there is 0 in f11. This column f11, there is a 0 here. So, you cannot cancel that. There is another 0 here in the column f13. So, you cannot cancel that. Similarly, f14 and f15 doesn't have 0. So, you can cancel them. So, similarly in row wise manner let us see what the columns are and the rows which contain zeros and doesn't contains. So, the first is leave first is automatically retained because there is 0. 2 again is retained because of the 0, 3 is retained, 4 is retained, 5 is retained, the row 6 doesn't contain 0. So, you can easily cancel that row.

Similarly, 7 does not contain 0, so I can cancel that particular row and so is 8. So, 8 can also be canceled as there is also no 0 in the row, f9, even that can be eliminated easily and so is the row 10 which doesn't have a 0. So, beyond that there are others like for example, there is a 0 in the row 11, there is a 0 in the row 12, there is a 0 in the row 13, and then there are no zeros in the row 14 and 15. So, you can eliminate them like this. So, what actually comes up as a result of all this, are certain zones or certain regions where you can really consider retaining those regions or zones. For example, there is a big zone which I write it here in this matrix which contains all uneliminated rows and columns. All those rows and columns which had been eliminated, you are trying to look into the matrix and see which zones which have emerged from the matrices. There is no elimination of any row or column. So, this is one zone of that particular matrix. Obviously, there is also other zones somewhere here which is completely emerging and you can say that this is a zone again which has come out which would be actually out of this f11 and f12 and f13 and the other one is f1 and f2. So, f1 2 f 5.

So, these are the two principle zones which have come out of the matrix which contains, so I am going to write down here two zones which are formulated with non-eliminated rows or columns and which also contain at least one 0. You can obviously see there is another zone which is coming up here which doesn't contain a zero. So, there is no use of retaining this because most of it is a null set that it is containing so. So, therefore only the 0 which have emerged from this matrix containing a 0 are to be considered. So, therefore obviously, there are going to be these phase f1 through f5 and on another hand the phase f11 through f13 which needs to be explored further about the relationship. So, retaining the f1 to f5 phases and f13 or f11 to 13 phases, these are to be retained. So, we say that these are retained and computer eliminates remaining all the other phases and then, we study in great detail the relationship which comes up among these particular phases.

So, we will probably in the interest of time close today and in the next week whatever first module comes up; we will take this problem up and solve this further.

Thank you so much.