Manufacturing Systems Technology

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Module- 05

Lecture- 26

Hello and welcome to this module 26 on Manufacturing Systems Technology. The last module we were talking about the variant approach for doing the computer assisted process planning. In context of that I would just like to mention that in the interest of time, I am sort of going ahead right now without delving in to the details of group technology. But I am going to actually do that mostly towards the end of the, the program when we enable to finish all the modules. One or two modules we will spend on how to do group technology or how to do this part families, which important for you to understand that how the CAPP system is able to identify on using a variant approach by looking at some of the sub parts or part level families, which have been made in contacts their similarities of manufacturing systems, or similarities of designs, or similarities of functionality.

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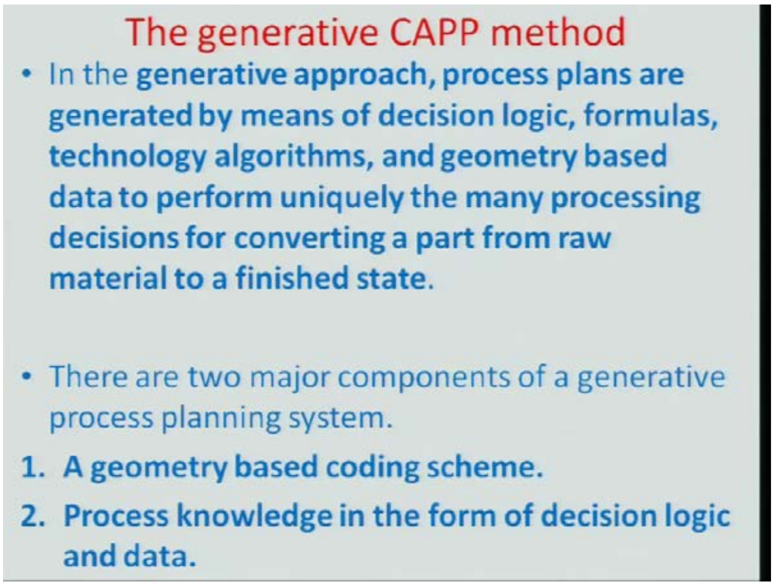

So, as of now we just go ahead and work on the different approach that is a generative CAPP method, which we had earlier illustrated. So, in this approach process plans are generated by means of mostly you know, it is first of all it is generated have been show. They are generated by means of decision logic, formulas, some technology algorithms, and geometric based data to perform uniquely the many processing decisions for converting parts from raw materials to a finished stage. So, we are trying to have a separate module where we really not looking at the variant of an existing process or a existing part of existing family; but rather than trying to create have been show part from the geometric requirements of the part has on the processing requirements that the part has. And here we are using some very logical tools. So, there are 2 major components of a generating, generate a process planning system. One is geometric based coding scheme and another is a process knowledge based scheme. And this process knowledge is typically arrived at very quickly through this decision logic and data and some tables and formats which are sort of helping the process to quickly identify and formulate knowledge about the process.

Another issue here is that the process knowledge derived from the experts in the processes itself. Or the manufacturing operators who are actually there of the supervisors who are actually there, that needs to be somehow, taped into the CAPP system. Because then the CAPP would be really a true CAPP which would propose two solutions to real life problems.

So, the knowledge based system again has an additional advantage that such decision tables or data are mind for variety of different operations. there are no rule based or condition based the selection or different criteria’s; let us say in case of a machining of a small shaft the diameter may matter or the length may matter in terms of a decision of an extra support. So, such variability’s are recorded as operator knowledge into the CAPP system. So, that’s one very good advantage behind the generative CAPP process. The process knowledge is a very critical component.

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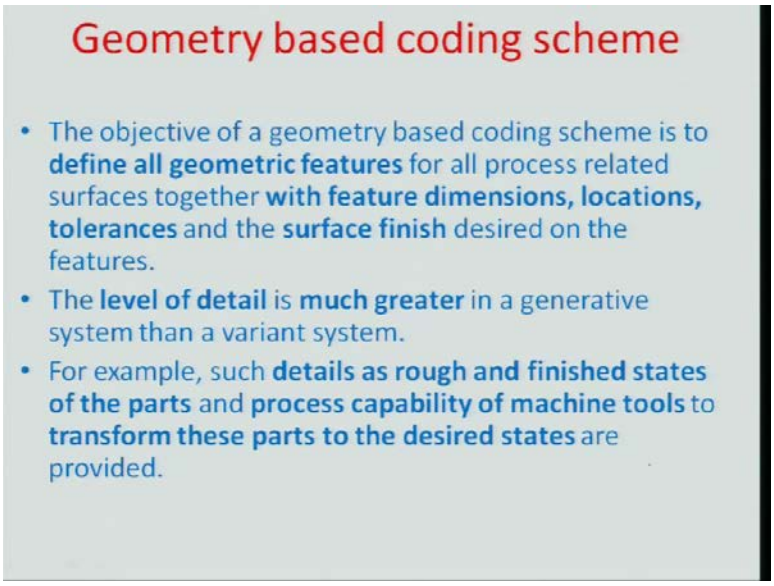

So, the geometric based coding scheme has a basic objective of defining all geometric features, and for all process related surfaces and that also with respect to the definition is with respect to the features dimensions. The location of the particular feature or the part in the whole assembly or the whole design that is been considered, and the tolerances over which these parts are needed for the assembly to work functionally in an appropriate manner. So, there are many aspects like feature dimensions, the location of the particular features, the tolerances and obviously, surface finish also which gives you an illustration of you know, sort of fits between the different surfaces in an assembly etcetera. So, these are all somehow obtained as a geometry level coding scheme or geometry level information, in this particular scheme.

So, the level of detail is much greater in a generative system then in a variant system obviously; because a variant is more related to, if you have an existing part geometry somewhere stored. We are just differentiating that in terms of the new requirement and the geometry existing. So, that’s only the plus delta data which gets needs to be mind there for determining a variant plan of the similar kind of a part family or a similar kind of a you know, sub parts in question. But here in this case it is a much more level of details because every part needs to be in terms of its geometry, feature dimension location, tolerances so on and so forth. Somehow a lot of data and there is no comparison between what is existing from the none existing. So, supposing if you are having many bolts or many nuts or many fasteners; each of them would be a separated entity here. So, that is the different in this particular scheme. So, obviously, details such as rough and finished stage of the part the process capability of the machine tools to transform these parts etcetera need to be provided. So, all these data are entered as for as the geometric based coding system are considered.

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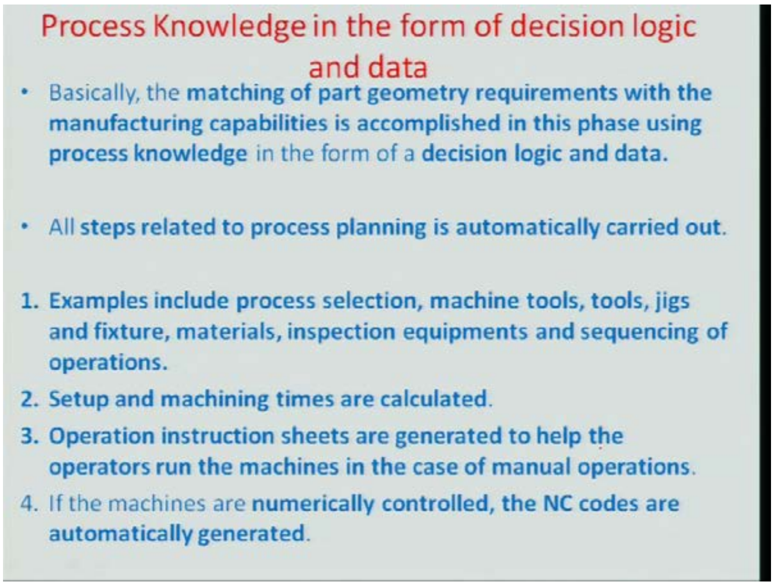

So, in the process knowledge based coding systems, the basic operation that need to be carried outs the matching part geometry requirements with the manufacturing capabilities. And that matching is the process knowledge, which really gets translated; for example, let say you have a option of choosing between 3 different machines for a particular surface finish or a particular tolerance level or a particular overall size related to the bed size of the machines etcetera. So, here the process knowledge is the knowledge derived as to let’s say if we want to make a shaft with a surface finish of ten microns we need to use a insulate for that. We need to use machine X or machine Y or machine Z for that.

So, that kind of a knowledge is kind of embedded from the experiential approaches done by several operators, who are there on the line handling the parts in the machines together and this integrates into the CAPP system of the process knowledge data. So, mostly the decisions are taken about the certain roud planning for the CAPP system and whether X machine or Y machine needs to be selected for a certain surface finish certain dais, certain size of the shaft that we are considering; by means of some kind of logic. And this logic is embedded in terms of some logic tables.

I am going to considered one or two logic tables and I am going to show you how such process selection can happen. So, all these steps related to process planning is automatically carried out; obviously, examples includes process selection, machine tool selection, tool jigs and fixtures selection, materials selection, inspection equipment selection, sequencing of the operations so on and so forth. Obviously, also setup an machining times are automatically calculated once, these selections and choices have been made and the operator operation instructions sheets are generated to help the operated to run the machine in case of manual systems in case of automatic system or the NC systems, it goes through the NC programming route that the data gets into the cam as you saw earlier. And these routes are then obeyed by the particular cam center in terms of machining control on the NC system which is present there.

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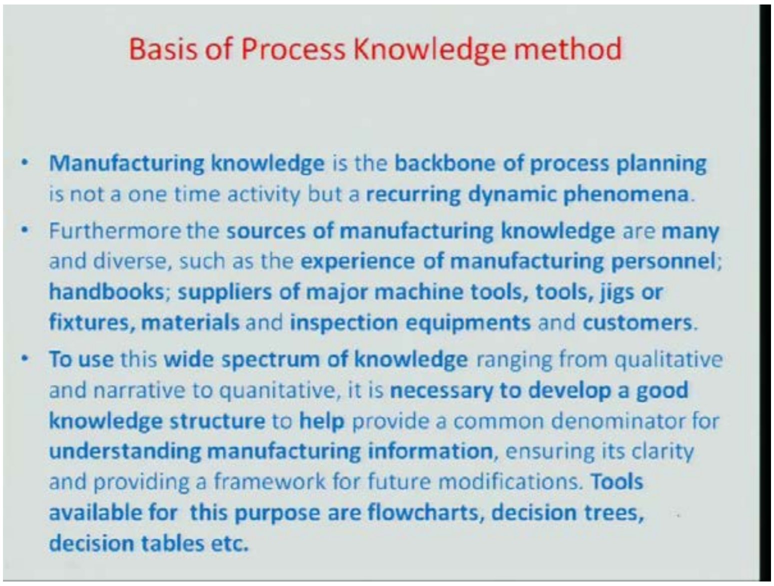

So, let us look at the process knowledge method. We all know that manufacturing knowledge is really the key or back bone in process planning. And it is not a onetime activity, but a recurring the dynamic phenomena. So, experience over the past so many years have been coupled up somehow as process knowledge and this knowledge is coming in to the system. So, the experience of manufacturing personnel for example, can be in terms of the hand books that they have over the machine tools or the suppliers of major machine tools or the tools jigsaw or fixtures materials inspection equipments customers all this kind of a share knowledge is called or is recall when we talk about different sources of the manufacturing knowledge. And however, you have to have a good structure. So, that you can identify the useful from the useless and only those important parts have to be considered when as for as the process knowledge goes here. So, let us look at some decision trees and decision tables, which we take as a practical example. To illustrate that how you do the machine selection.

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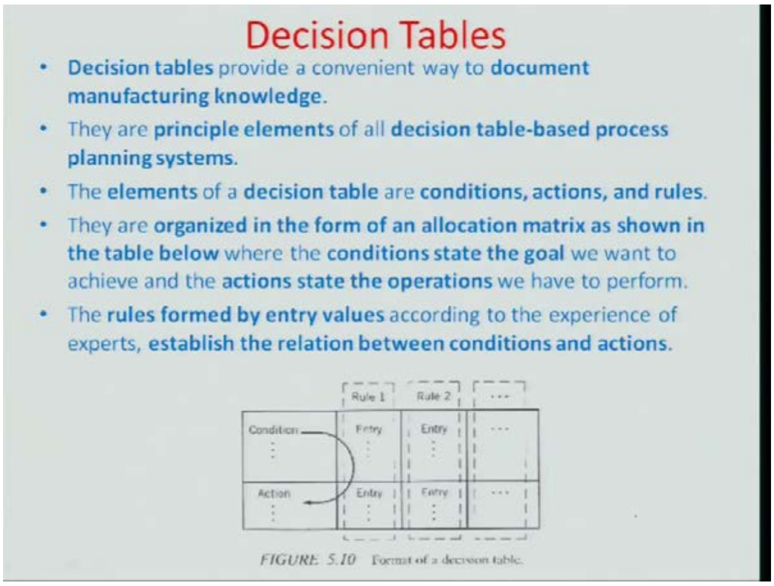

So, what is the Decision table? So, it provides a convenient way to document manufacturing knowledge, let us say this kind of you know is a representation. So, you have something called a condition, something called action here, there rule which is there I am going to explain each and every part of it in details to problem examples. So, there are principle elements of all decision tables and the elements of a decision table are conditions, some actions, and some rules. These are the 3 elements which are contained in a particular decision table and; obviously, they are sort of organizes are allocation matrix as you can see here. So, this is more like a matrix type of an orientation, that you have.

The word condition really means the goals you know. So, the goal may be to turn a particular shaft of diameter so and so on, length so and so, to a certain tolerance level. So, that is the overall condition of the goal of the manufacturing operation that needs to be plan for example. So, for that we need to achieve the actions stated for the operations. So, that we can perform the compliance of the goal, that has been planned earlier. So, the actions are those operations or those sequences of operations which are conditioned by certain governing rules and the rules are based on the experience of the manufacturer personal. So, that the values here, entries correspond to a certain condition or a certain action with respect to the certain rule.

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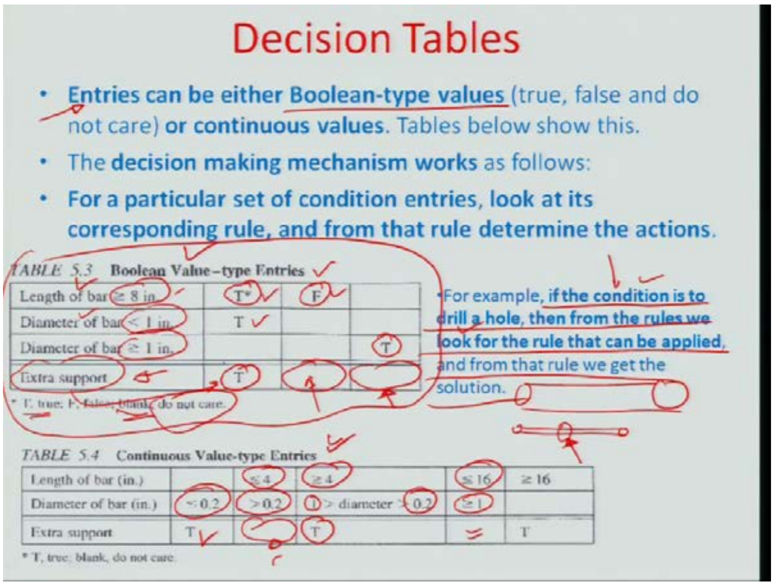

Let us look at it. So, let us say there are 3 different cases here, in one we are trying to considered a Boolean time of entry in the particular decision table are shown here. the condition here that we considered is to drill a hole and then from the rules we look for the rules that can be applied and then from the rule we get the solution something like that. So, the overall condition is to drill a hole and the hole is drilled in a bar which is let us say greater than or equal to 8 inches. and the diameter of the bar is about less than 1 inches then one case and another case is greater than or equal to one inches. And the action that needs to be taken as an extra support which is provided for handling this particular bar for the drilling operation on the lathe. We are using the turning center for doing a drilling. So, it is basically coming from the tailstock side and trying to drill the bar. And the question is whether you need or need not provide an extra support. So, that is the action criteria that you are considering here.

So, the rules have been set up in the following manner using Boolean type of representation, that if the length of the bar let us say is 8 inches we represent this by a true value here. meaning there that the length is 8 inches and let see the diameter is less than an inch. So, in that event you will have to necessarily use the extra support. So, there is a true value in the extra support. So, the action has to be executed in this type. So, what is the condition the condition is basically to drill a hole in a particular bar which is 8 inches probably in diameter, greater than or equal to eight inches in diameters in length: I am sorry. And less than one inches in diameters and then you have a rule governing saying that if these two are the true values then; obviously, you need an extra support for that.

If suppose in the length is less than 8 inches so; obviously, the length of the bar in that case is false. Because the length is less than 8 inches and you do not really care at that point if the length is less than eight inches to provide or not to provide an extra support. So, you keeping this empty the blanks means here do not care. Similarly if the diameter of the bar is let us say greater than or equal to one inches also even if the diameter is high. We do not need to keep an extra support or we really do not care if even whether it contains an extra support or not. meaning there by that there is cut of value we have illustrated here that if the diameter of the bar is less than 8 inches or the length of the sorry, the length of the bar is less than eight inches or the diameter of the bar is let us say greater than 1 inches, also we do not really care whether an extra support should be provided or not. So, this is a logical representation in a decision table for the condition which is drilling a hole, using turning center. And you can see how with the true false entry you have represented the various rules here.

The rule says only in case the length of the bar exceeds 8 inches, and the diameter is less than 1 inch or. So, you need to use extra support otherwise we really up. Not worried about if the diameter is if the length is less than 8t inches or if the lets say the diameter is greater than 1 inch. We really need not care whether the support is there or not.

So, in a logical way you are representing using this decision table or logic table. There can be another way of representing a same thing using continuous value entries, here it is more related to really the cut of values. Beyond which the extra support would be needed. but there can be some sub values where they are may or may not be the need of an extra support which gets carried out; for example, in this continuous value entry table you see, if the length of the bar is less than or equal to four inches and the diameter is greater than 0.2 inches. You not worried about whether the extra support would be needed; however, if the diameter of the bar is less than or equal to 0 point 2 inches. you definitely would need an extra support; obviously, if the bar is a smaller and smaller, let us say from this value the bar has gone to this particular value. So, the providence of an extra supports somewhere here is needed otherwise they will be a bending or the sagging of the bar on your doing machining. So, here also for example, if the length of the bar is greater than equal to 4inches and the diameter is within 1 and point 2 inches again extra support is needed. if the length of the bar is less than or equal to 16 inches and the diameter is greater than or equal to one inches, we do not care whether the support is to be provided.

But however, if the length of the bar is greater than or equal to 16 inches, you do need a an extra support as has been seen here. So, this is various ways of representing the same problem and in so, you know the continuous value entries are more tougher I would say to represent the same condition as here. There is mode of a cut of representation in the Boolean type entries, but in the continuous value entries there may be a lot more details then the Boolean type entries in terms of exactly what is the cut of length or cut of diameter beyond which you would be able to use an extra support for the manufacturing advantage of the particular system.

So, this in a nut shell is what decision tables are, I am going to represent ah a logic table in the next problem example, but I will would like to do that in the next module.

Thank you