Manufacturing Systems Technology

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Module - 06

Lecture -34

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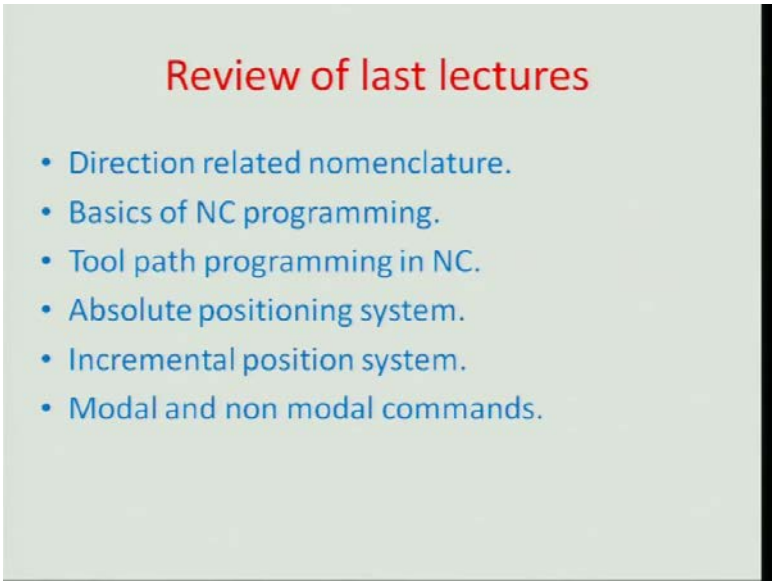

Hello and welcome to this "Manufacturing System Technology-Module number 34. A quick recap of what we were doing in last module. We were talking about the various issues related to the nomenclature of directions, particularly in NCC NC system and in context to that, we referred to all the motions along the x, y and z axis, first formulated the axis. Remember the axis was a part of the spindle which would automatically apply cutting power in case if it is a tool or turning system, it would be the tool which would carry the axis z and if it is work piece turning system as turning center or a lathe machine, it would be the work piece axis which would be the z axis. In that respect, what we tried to define out is that if the tool moves away from the work piece that is really the direction of positive z and axis. If it is moving towards the work piece, it is you know considered to be the negative z axis. We also laid out the foundations of how you do the x and the y direction accordingly based on z motion of the tool going towards the work piece and away from the work piece and then, finally evaluated it in case of system

which would have tools spindle or a work piece spindle.

So, we also talked about rotation nomenclature and typically used the right hand grip rule to see if the direction is clockwise or anticlockwise as is supposed to be positive or negative, and with grip rule you can ascertain if the finger points to the positive direction, the direction of curling of the other fingers you know, if the thumb points to the primary direction in the positive axis towards the positive axis, then the other curling fingers of the right hand would then give you an essence of what is the direction of rotation. So, that would be the positive rotation directions along that particular axis. We also referred to basics of NC programming where principally you as a programmer write the tool and assume that the tool moves parallel to the contour of the topology which you are machining.

Obviously, there is a question of whether the tool is circular tool or a single point cutting tool. If it is single point cutting tool like let us say the turning tool in a turning center, there the tool tip can be assumes to be the path of the tool or motion of the tool. In case there is a circular cutter like in case of multiple point cutting tools of milling etcetera, you can consider that there is path of the center of that particular tool which is always compensated by radios R which is parallel to the contour of the topology that you are wanting to machine.

So, all the programming has to be done with tool as a reference, not as a work piece. Supposing it happens if the controller decides that for certain is more, it is optimum to probably move the work piece, it will do so on its own. So, that is what the whole idea is behind this process. Obviously, you also assume sometimes that cutter is compensated in the program, and sometimes you assume that the cutter compensation has to be yourself given. So, the programmer should know numerically about these values. We also talked about different positioning systems, and in context to that we discussed about the absolute positioning was the incremental positioning system absolute being with reference to the origin or zero and it would be in terms of mapping the points which are in question again and again with respect to the origins.

So, this was intensive in part of the operator with the programmer. We would have to map the dimensions of motion based on looking at the reference point of the origin always. The other would be the incremental where you would go from one point to the other point and move just in about you know a certain amount of distance in certain

direction, and it would be a lot of exhaustive calculation, backend calculation of the part of the control which would then define what is going on with reference to the global coordinates of global origin.

So, we also talked about module, non-module commands where module commands are one which sort of remains when fed for example, feeding speed or let us say rate of rotation. Unless and until you change that counter, the command prevails and that is specifically change the counter to executive the command in a different manner. For non-module is the other way round, that once the command has been executed, it automatically washes off. The command count is empty unless you reprogram it back. For example, if you talking about dwell time, dwell time is only supposed to be a one period. We want the dwell time should be reset to 0 automatically unless the operator wants to get involved and decide that there is dwell time in some other region and the machining of the particular work piece. So, this is what has been covered so far in the NC programming system. Let us look forward a little bit, develop a good syntax or a good language you know which would be then quite repetitive and very logical, so that the control can understand the communication between the external manual operator and govern that in terms of operations to the machine, ok.

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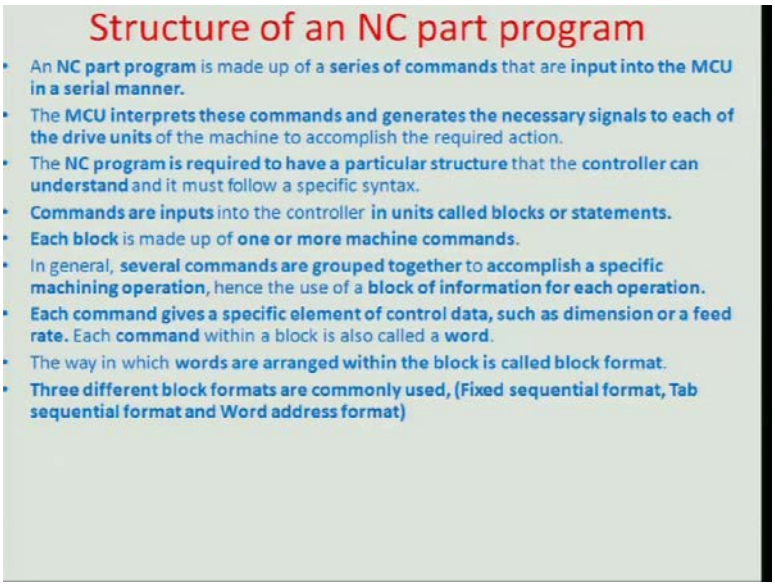

So, obviously, the structure often NC part program is made in a manner, so that the whole structure is made up of a series of commands and these commands are input into the NC in the serial manner. So, there should be a way of reading serial 1, 2, 3, 4 in that manner, so that the reading of the controller can be as per the reading of the index

number. So, there has to be indexing numbers somehow for the different commands. Obviously, the MCU then should interpret these commands and generate the necessary signals to each of the drive units, or stepper motor or dc motor as discussed in the last modules and that should be able to accomplish the required action in terms of machining. Then, the NC program should have a particular structure as specific syntax which is understandable as global syntax which can be then repeated by all, so that any new programmer can interact with the controller and be able to generate these necessary signals in terms of these commands to the controller, so that machining can be carried out over all work centers.

Just as you have language, you can design the syntax in a appropriate manner, in a commensurate manner in language, for example you have some words which you know get into sentences and the individual words when are made much sense, but if they are put into a certain grouping, then that actually starts making sense and you can understand that language. In a similar manner, commands are basically made in units, call blocks or statements and each block or a statement that is sentences made up of one or more machine commands which act as words. So, you have small commands of the machine and they are all absurd and then, you know you place them just without the sequence, it doesn't make any sense, but if you develop a sequence of these words together that makes statements or sentence in a language. So, in the same manner the command should be sequenced in a particular manner, so that it starts making sense to the controller and it can start understanding.

So, two aspects here should be remembered. One is independent command unit and then, several such units in a certain sequence building what you call a block or a statement and then, there are several blocks just as there are several sentences in paragraph, there are several blocks that can go and make the whole program of the NC for doing the particular part machining that is in question. So, there are several commands in general which are grouped together to accomplish specific machining operation and hence, the use of a block of information for each of these operations is needed, and each command gives a specific element of control data such as dimension or feed rate as I will just show you. Command can also be recorded as a word just as you know the language syntax and words are arranged within the block in a certain manner. There is a format for this arrangement which is there, which is also incidentally known as a block format. If you really look at the various formats which have evolved your time, the earlier generation

machines used to just have sort of numerical driven control without using of any English alphabet or any English words. One of the reasons why the name numerical control came into picture and this is also subsequently was called as a fixed sequential format. I will try to explain how this happens first.

Obviously, as you will see in the fix sequence format of the arrangement of the various words that we are talking in a block, there are certain repetitions which are very unnecessary and time consuming. So, therefore the next available format utilizes the tab button. You always have a tab button in a computer, you almost have seen, so that you could repeat some of the values from the last line without really specifically having to enter it. So, you have one tab and then, other tab without a value. So, obviously the row and column address of that particular sentence would be repeated just because of these two tabs. So, you don't have to exclusively mention the value every time. So, it saves some programming time. So, that kind of a format evolved. So, that is called a Tab Sequential Format. Then, finally the latest one obviously has not only you know all numbers, but also little bit of addition of words which changes the domain because then, you can actually specify, you can identify the particular unit command in a particular block in a very easy manner. I will show all these things by practical examples, so you can get a good feel of how these processes have been accomplished.

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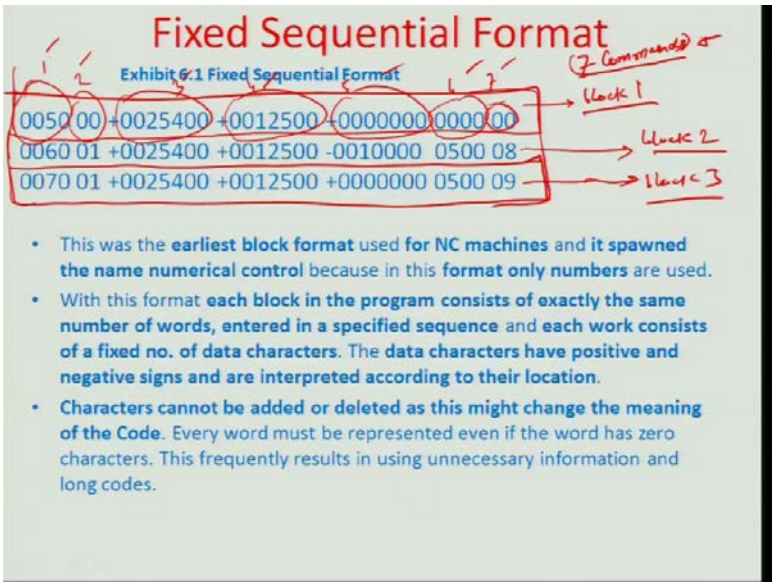

So, let us look at the fixed sequential format and if you just look back here to this zone of the slide, it talks about a program. It is a three line program. So, obviously you can see these different you know numerical values at these different locations which probably

mean something. So, there about 1, 2, 3, 4, 5, 6 and 7 such numerical values and each of them must be having some meaning and then, there are such sentences or such blocks to this whole area here, right over here you know of the first line of entities, numerical entities is referred to as a block. In fact, you have this as block 1 and similarly, you have other two entities here probably this particular line and then, there is another line in the bottom right about here as the two different blocks, block. Let us say this is Block 1, I am sorry. This is block 1, this is block 2 and this is block 3. So, there are three blocks which are there. Further each block would have now these 1, 2, 3, 4, 5, 6 and 7 commands. So, each of these seven commands probably mean something.

They are also sequenced in some way, so that you can have a certain understanding and this is the way that the fixed sequential format was first constructed. We are looking to each aspect of the fixed sequential format to sort of gauge what would be the, what is the most current standard in the programming and this what was the evolution point from which NC programming started to take place. That is why the name numerical control came into the picture.

So, to the interest of time I think we will close this module now, but in the next module I am going to dive into the details of what is the meaning of each unit command in such a sentence and then, give you basic of how these commands are in a certain sequence mean certain instruction to the controller to be given then to the machining learner.

Thank you.