Automation in Production Systems and Management
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Fundamentals of NC Technology - II
Lecture - 23
NC Part Programming - II (CAD/ CAM, MDI)

Our discussion will be on NC Part Programming.

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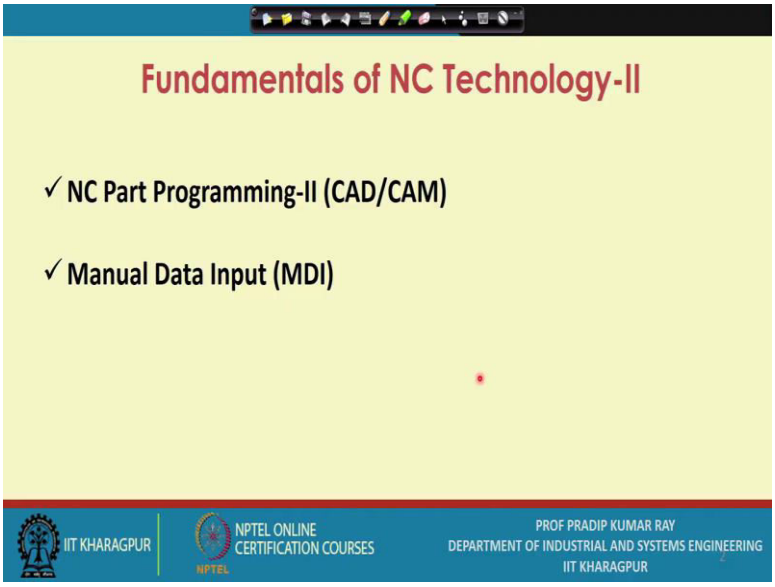

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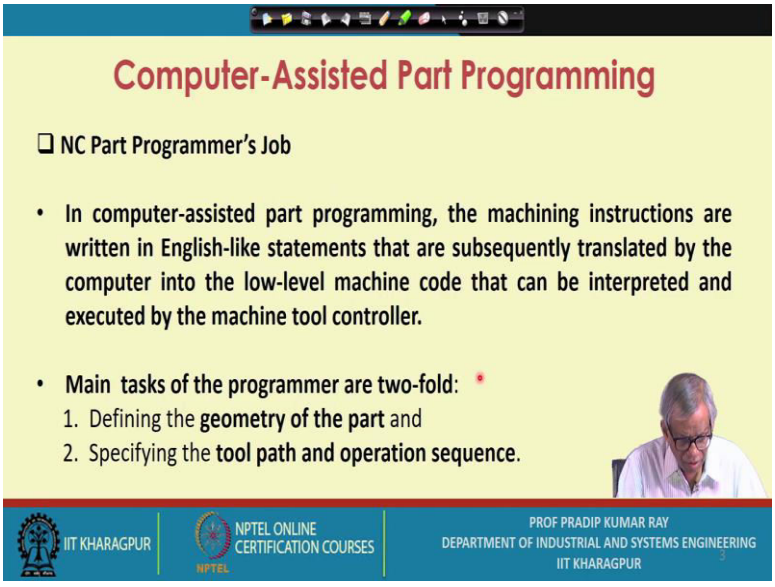

In computer-assisted part programming, the machining instructions are written in English-like statements that are subsequently translated by the computer into the low-level machine code that can be interpreted and executed by the machine tool controller. The two main tasks of the programmer are: Defining the geometry of the part and specifying the tool path and operation sequence.

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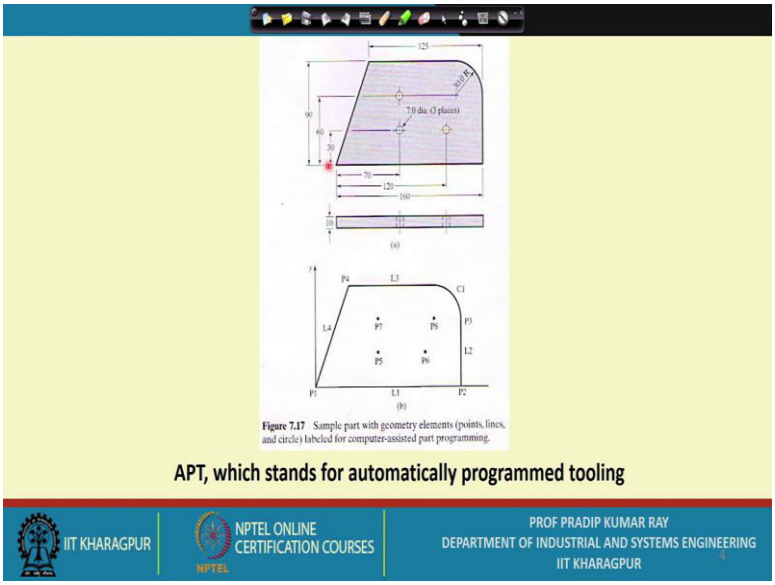

This is just one example like say you may use a particular language which is widely used that is called automatically program tooling on the APT language.

you have to move the tool in horizontal direction from one point to this point, the location must be known and similarly here the tool takes a turn 90-degree trans it moves over there then there will be this curve, you have to specify the radius value, while you define this curve and again it moves in a straight line then takes a turn.

The turning angle of the cutter or the tool you have to specify and then again, this path you have to decide. So, this is one example. Points the lines, then the circle, this is the circle. So, these are the geometry elements.

In this case the three specific geometry elements you have to identify one is the point, second one is the lines and third one is the circle. So, these are the terms and terminologies you are already aware of in fact.

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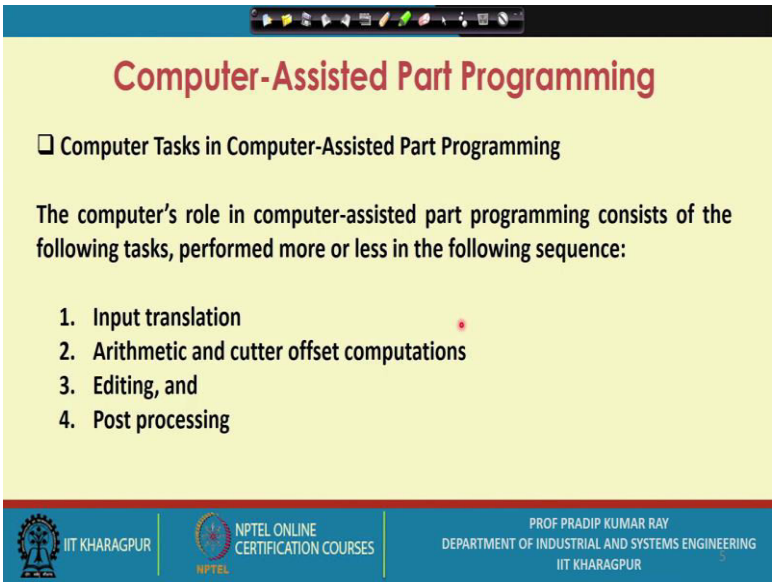

These activities will be carried out as a part programmer. The computers role in computer assisted part programming consists of the following tasks, perform more or less in the following sequence. Input translation. Arithmetic and cutter offset computations, Editing, and Post processing

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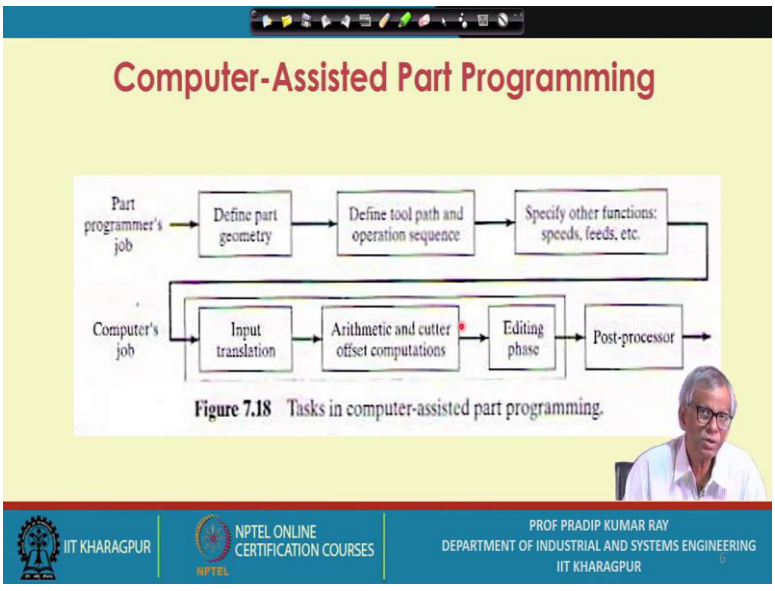

You just look at this figure and if you study this figure you will come to know what are the activities you carry out and what are the activities the computer does. Part

programmer jobs define part geometry. The tool path and operation sequence, whether it is a drilling operation or milling operations or turning operation that you have to specify.

Because depending on the type of geometry whether it is a flat part or the cylindrical part. Next you have to specify other functions because these functions like speed, feeds etc.

So, you have a detailed process plan and you get all these data or information also from the process plans, then what you do you feed in the computer. The first thing it does that is input translation and it is to be written in a particular code and this code is to be translated, this activity is referred to as the input translation. Then arithmetic and cutter offset computations offsetting, the cutter the moves in a particular path.

The actual path of the room or the part may be different, the cutter diameter must be known and usually the offset have to be calculated, offset could be the radius of the cutter, offset calculation with some the trial-and-error exercise is there and then you specify the offset.

Because you have to mention the location of the cutter also with respect to the surface, with respect to the lines or with respect to the points, with respect to circle with which you de the object or the part, arithmetic and cutter offset computation activity will be there.

Third one is the editing phase, editors will be there, they will edit it properly and then the post processors.

These are three activities you carry out and four more activities to be done by the computer, that is why it is called computer assisted part programming.

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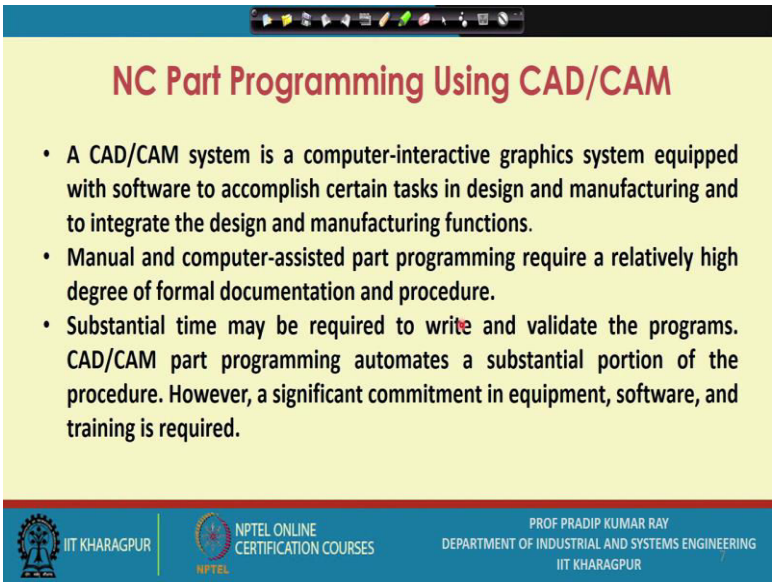

A CAD/CAM system is a computer interactive graphics system equipped with software to accomplish certain tasks in design and manufacturing and to integrate the design and manufacturing functions.

Another is Manual Data Input. Manual and computer-assisted part programming require a relatively high degree of formal documentation and procedure.

There is lead time required to write and validate the programs. CAD/CAM part programming automates a substantial portion of the procedure, but a significant commitment in equipment, software, and training is required.

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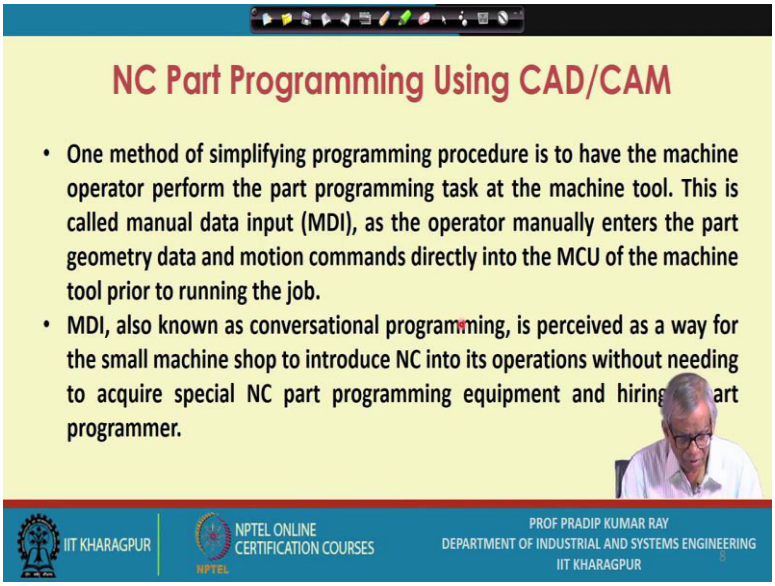

One method of simplifying the procedure is to have the machine operator perform the part programming task at the machine tool. This is called manual data input (abbreviated MDI) because the operator manually enters the part geometry data and motion commands directly into the MCU prior to running the job.

MDI, also known as conversational programming, is perceived as a way for the small machine shop to introduce NC into its operations without needing to acquire special NC part programming equipment and hiring a part programmer.

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MDI is NC machine tool, there is a touch screen and on the touch screen one can download the program for particular part. Either the program has already been written by another part programmer or the operator have to write down the program.

So, download this particular the program and that what is the part, what is a part geometry and you start verifying the part programming as per the process sequence. And suppose for one part you are using one part programmer.

Now for the second part in the same shape, size, same material, but the dimensions are different.

You just the download particular program and then you have to do number editing and then the editing is complete.

MDI permits the shop to make a minimal initial investment to begin the transition to modern CNC technology.

The limitation, of manual data input is the risk of programming errors as jobs become more complicated. For this reason, MDI is usually applied for relatively simple part. there are three kinds of jobs we have; skill based, rule based and the knowledge based, their jobs are basically a combination of all three types.

A minimum of training in NC part programming is required of the machine operator to be involved in MDI.

The operator must have the ability to read an engineering drawing of the part and must be familiar with the machining process.

Here one important issue that is called the use of group technology principles group technology.

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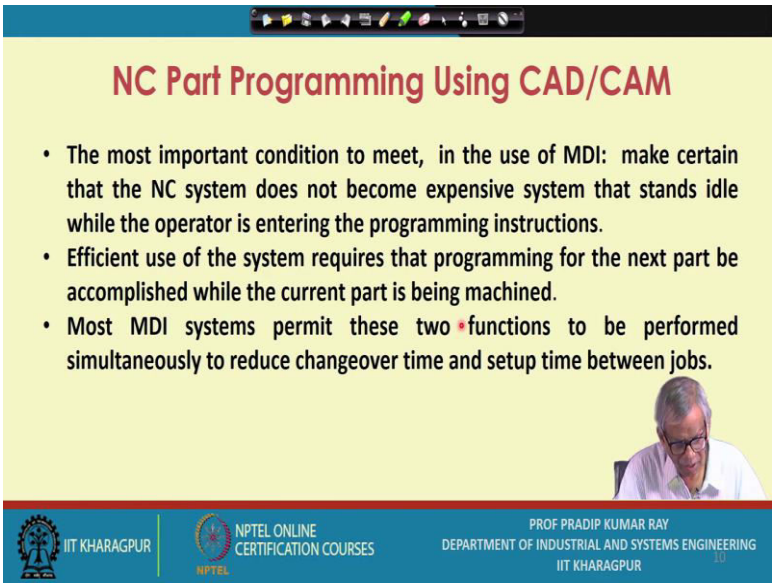

The group technology means the several parts will be dealing with batch man production system.

First, you establish the similarity between the two parts then combine them together into one particular unit. And this unit is basically called family and this is referred to as the part family, the part family formation is the first task.

Cellular manufacturing system in application of group technology is where the entire population of parts may be grouped under several part families. Similar parts and each family is having the similar parts, similar in design attributes, similarly similar in manufacturing operations, for that part family you have one master process plan.

An important caveat in the use of MDI is to make certain that the NC system does not become an expensive toy that stands idle while the operator is entering the programming instructions. Efficient use of the system requires that programming for the next part be accomplished while the current part is being machined. Most MDI systems permit these two functions to be performed simultaneously to reduce changeover time between jobs.

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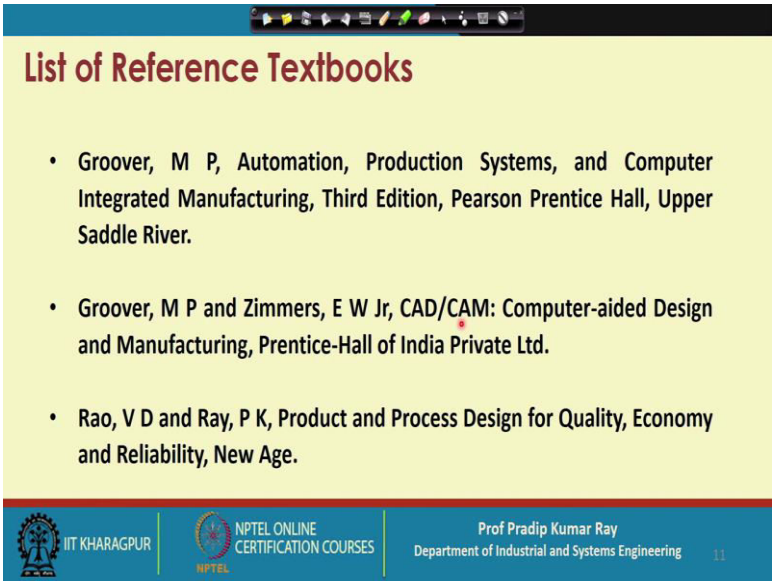

These are the reference textbooks that you can refer.