

CNC and DNC Systems: A Future Approach

Abhishek Dixit
Mechanical Engineering
Jodhpur Institute of Engineering and Technology
Jodhpur, India

Vikas Dave
Mechanical Engineering
Jodhpur Institute of Engineering and Technology
Jodhpur, India

Abstract:-The main objective of the paper is to provide a common environment where the evaluation of a given general order and later composition of work orders, and designation of production resources could be done automatically under the operator's supervision. The model is functionally included into the five level computer-integrated manufacturing (CIM) hierarchy. Functions of the model are plugged into the lower four levels by means of technological database management system that supports main functions of information flow, which flows through the backbone of CIM system. CNC stands for computer Numerical Control and been around since the early 1970s. Prior to this, it was called NC, for Numerical Control. While people in most walks of life have never heard of this term, CNC has touched almost every form of manufacturing process in one way or another. If you will be working in manufacturing, it is likely you will be dealing with CNC on a regular basis.

I. INTRODUCTION

The problems of equipment maintenance, online machine tool designation and control over the production flow forced the integration of tasks that were formerly distributed between the two levels. The fact is that shop floor data emerge from the production process so they need to be treated at the same time and in the same place as the production data. To deal with this fact in an effective way the DNC concept was broadened to meet the requirements of machine tool and production data acquisition as well as to fulfill some present needs of production environments.. These are mainly caused by the more and more important role of maintenance tasks, which are nowadays already incorporated into production plans. In this manner the DNC concept was not only broaden—it got the completely new meaning, so we can talk about a new DNC concept, DNC concept of third generation.

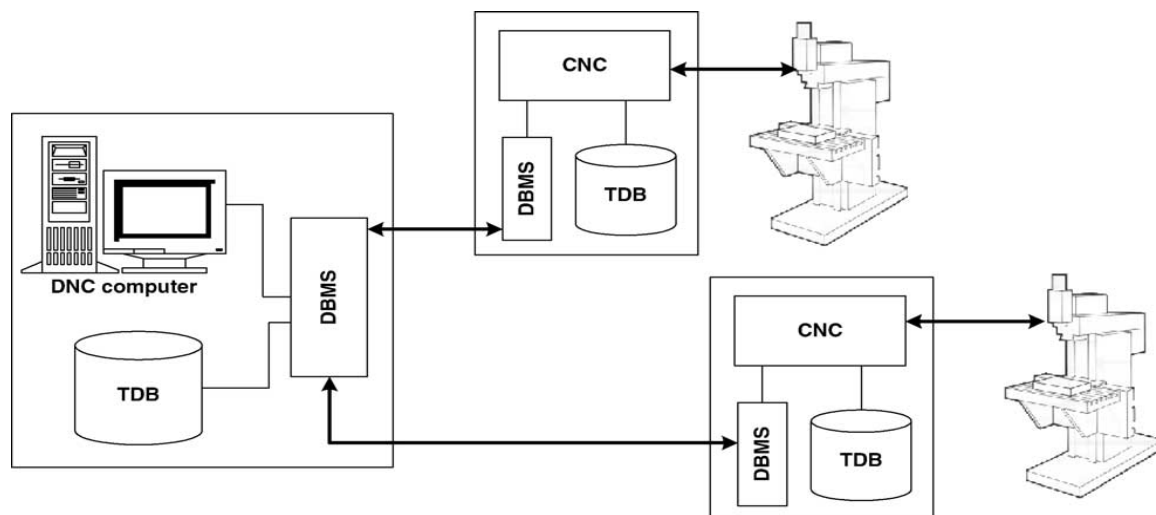


Fig 1: DNC concept of third generation

II. HOW CNC WORKS

Working of CNC system involves certain steps which are enlisted below and explained in brief:-

A. MOTION CONTROL

All CNC types share this commonality: They all have two or more programmable direction of motion called axes. An axis of motion can be linear or rotary. One of the first specifications that imply a CNC machine complexity is

how many axes it has. Generally speaking, the more axes, the more complex the machine.

- B. MACHINING CENTERS;
- C. AUTOMATED TOOL CHANGER
- D. SPINDLE SPEED AND ACTIVATION.
- E. COOLANT

III. CNC SYSTEM

Think of giving any series of step-by-step instructions. A CNC program is nothing more than another kind of instruction set. It is writing in sentence like format and the control will execute it in sequential order. step-by-step. A special series of CNC words are used to communicate what the machine is intended to do. CNC words being with letter address. When placed together in a logical method, a group of CNC words make up a command that resemble a sentence. The CNC control will interpret a CNC program and activate the series of command in sequential order. As it read program, the CNC control will activate the appropriate machine functions, cause axis motion, and in general, follow the instruction given in the program.

A. WHAT IS A CAM SYSTEM

For simple application, the CNC program can be developed manually. That is a programmer will sit down to write the program armed only with pencil, paper, and calculator. Again for simple applications, this may be the very best way to developed CNC programs. As application get more complicated and specially when new program are required on a regular basis writing a program manually, CAM system is a software program that runs on a computer that helps a CNC programmer with programming process. Generally speaking, a CAM system will take the tediousness and drudgery out of programming.

NC WORDS: - A NC Word is a collection of characters used to form instruction. The typical NC words are X-position, Y-Position, Z-position, feed rate, speed etc. A collection of NC-word is called a block. Following are the NC-words used for the formations of blocks. All the NC words may not be used on every CNC machine. This language having NC- words is called EIA RS-274D standard format or G&M Code programming.

The different NC-words are:- N,G,X,Z,I,K,F,S,T,M, and they are followed by a number:-

1. N-Word;-Sequence Number or block number, each instruction line is a block. The N word is a address of block number.
Ex;-N09-is the ninth block (line) in the programming.
2. Preparatory Function (G-word):- Preparatory function tells the machine to prepare for the type of the cut and programming mode. The preparatory words are denoted by G code a special function.

B. NC APPLICATION CHARACTERISTICS

1. Batch production;
2. Repeat orders;
3. Complex part geometry;
4. Much metal needs to be removed from the work part;
5. Many separate machining operations on the part;
6. The part is expensive;

C. NC FOR OTHER METALWORKING PROCESSES:-

- Punch presses for sheet metal hole punching;
- Presses for sheet metal bending;
- Welding machines, such as ox fuel cutting;
- Thermal cutting machines;
- Tube bedding machines;

IV. IMPORTANCE&ADVANTAGES OF NC

1. Nonproductive time is reduced;
2. Greater accuracy and repeatability;
3. Lower scrap rates;
4. Inspection requirements are reduced;
5. More complex part geometries are possible;
6. Engineering changes can be accommodated more gracefully;
7. Simpler fixtures are needed;
8. Reduced parts inventory;
9. Less floor space required;
10. Operator skill

V. DNC SYSTEM

Once the program is developed (either manually or with a CAM system,) it must be loaded into the CNC control. Though the setup person could type the program right into the control, this would be like using the CNC machine as a very expensive typewriter. If the CNC program is developed with the help of a CAM system, then it is already in the form of a text file.

Direct Numerical Control: The first attempt to use a digital computer to drive the NC machine tool was DNC, This was in the late 1960s before the advent of CNC. As initially implemented DNC involved the control of number of machine tools by single (mainframe) computer through direct connection and in real time instead of using a punched tape reader to enter the part program into the MCU, the program was transmitted to the MCU directly from the computer one block of instructions at a time. First of all DNC isn't of importance to companies that don't have CNC machines. However, if the reader of this document works with or is interested in CNC machines,

then DNC can be important. As a definition DNC is an acronym that can mean Distributed Numerical Control or Direct Numerical control depending upon the application. Another definition for Direct Numerical Control is that it is a data communications system connecting a group of numerically controlled machines to a common computer that has substantial memory for the storage of numerous numeric control (NC) part programs and has provision for on-demand distribution (downloading of NC Programs to the machines). Usually this type of system has additional provision for the management, display and editing of NC part programs. These days when someone uses the term DNC they are usually referring to Distributed Numerical Control where a NC program is sent from a personal computer (PC) to the memory of a computer numeric control (CNC) machine. The program runs from the memory of CNC machine.

Or, if the program that is to be run is bigger than the capacity of the memory of the CNC control, the program can be run directly from the computer. That is when we refer to DNC as Direct Numerical Control. This process is also called trickle feeding or drip feeding.

A. TOOLS WITH CNC VARIANTS

- Drills
- EDMs
- Lathes
- Milling machines
- Wood routers
- Sheet metal works

- Hot-wire foam cutters
- Plasma cuttings
- Water jet cutters
- Laser cutting

CONCLUSION

An effective approach to the production planning tasks is nowadays a crucial factor for a competitive company in a modern global market [16]. Shop floor is a place where a new value is added to the raw material. Therefore, will quality and accuracy of the production process in the shop floor directly affect the costs and indirectly the profits made in the market. The described paper not only gives a possibility for partial automation of time-consuming processes, but rather tends to introduce new methods and principles of process planning tasks. The presented idea of the technological database is unique in its structure, which gives a possibility of many different data manipulations that can be used for various automation purposes. It is suitable also to be incorporated into the CNC control device, what gives some new control possibilities to the operator and for the first time enables the production manager to gather the actual production data by a mean of simple queries incorporated into the database management system. The wealth of information gathered this way is far beyond the scope of DNC systems known in a nowadays market. The operator can combine different data to get any important conclusion he or she needs. Besides, the technological database is open and can be upgraded with different data sets to give a user a possibility to build his own information frame.

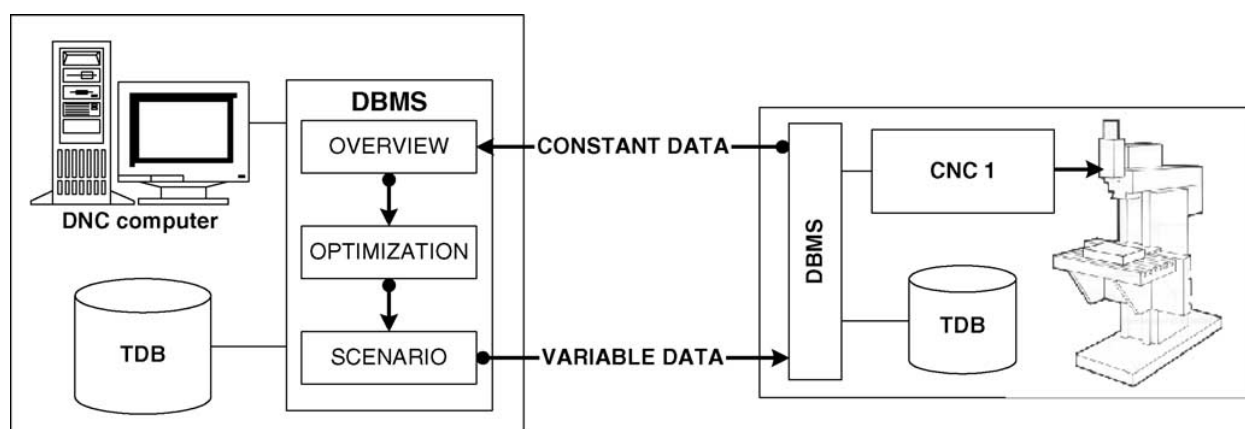


Fig:-2 Data flow in a DNC system

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