

T.3. G.M. AJIT—Advanced Microcomputer Based Numerical Control System—1984—Dr. C.S. Sridhar

A Computer based numerical control system replaces hard wired logic circuitry with a general purpose Software Oriented processor, flexibility being the most significant benefit. Primary function of any NCS is to sequence the axis of a m/c tool through the steps of a part program and it is grouped into three as (i) Data input (ii) Axis Control (iii) Sequence Control.

In this thesis, modularity in hardware is achieved by adopting a popular micro computer bus standard namely multibus IEEE 796 and the hardware consists of only five multibus compatible boards and standard peripherals. All modules connected to the multibus standard behaves in a master slave relationship. The multibus data transfer operates on a handshaking principle so that no one module depends on another's internal timing. The maximum rate for the bus being 5 MHz.

Interpolation, the most important computational task performed by a NC (contouring) system is carried out with the help of an IC chip KM 3701. KM 3702 is the Servo Control IC closed loop system is used for axis control to get better performance. The position feed back is provided by an optical encoder and a resolver coupled to the end of the axis motor. The encoder based control system consists of an up-down counter, a digital to analog converter, power amplifier and a DC Servo motor. The encoder interface circuit has to sense the direction of movement, generate the countup and countdown pulses to be fed to the KM 3702 which is achieved with a quad latch and a PROM chip using the circuitry proposed by Ciancaghini. The hardware requirements in the micro computer board to be used for the CNC system is met with an 8 bit microprocessor - Z80 A. Optically isolated input and output board are used to meet I/O system requirements.

The Software is designed as a portable modular package enabling it to have a value and lifetime greater than any particular hardware environment. The special features of the package include a powerful machine tool operating system MTOS with file management, provision for simultaneous operation as a CNC System and as a voice input tape preparation system, angle programming, Safe zone

programming etc. and all other advanced features found in modern CNC System for lathes. THE CNC System designed here is a two-axis contouring control for lathes i.e. x and z axis. The system for developing the Software consists of Z-80 based μ c, power supply, dual mini floppy disk drives, CRT terminal, printer along with floppy disk based Z-80. assembler and text editor program. The control panels to be scanned consists of the front panel of the CNC system and a remote control panel mounted on the machine.

The System Software Scans the % " μ " feed rate switch the real time interrupts service routine execution and up dates the O/P feed rate if required. The rotary switch O/-P are interconnected so as to supply a 4-bit binary number corresponding to percent of override selection as input to the system. The main function of the software module is to decode the part program and execute it. The programming format is prepared in accordance with the recognised ISO, DIN and EIA standards. In order to reduce the delay between the execution of the blocks of part program to a minimum, the entire part program is compiled and stored in separate buffers. The compilation is done during every active cycle, start from the present block to be executed to the last.

A Voice recognition module (VRM) is also tried for data entry. The Software is developed using assembly language and the complete CNC system is tested by interfacing it to the NHCNC lathe located in HMT Ltd. Kalamassery.