

Machinist Toolkit: NC Files Sequence Generator

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Project Guide¹, Students^{2, 3, 4, 5}

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Abstract

Part of the Machinist toolkit is the NC File Sequence Generator, a versatile software program for generating numerical control (NC) files used in numerous industrial processes. Lathes, milling machines, and 3D printers are examples of CNC (Computer Numerical Control) equipment that require NC files to operate.

They come with all the instructions needed to make precise and elaborate pieces. This software will be helpful to engineers, machinists, and manufacturers who want to automate the creation of NC files efficiently.

This project showcases a VB.NET application created to solve a significant problem in the Power MILL 360 software's production workflow. All programs for a tool are assigned the same program number (O1000) by the software that creates programs for CNC or VMC machines. The machines become confused as a result, unable to understand the order of the programs. Reassigning the program numbers to an ascending sequence manually is the current option, which takes time and reduces productivity. This procedure is automated by our application, which creates an ascending sequence of NC files in a matter of milliseconds. In addition to saving a great deal of time, this increases production efficiency and offers a useful fix for a recurring issue.

Keywords: *- Machinist Toolkit, NC Files, CNC or VMC machines.*

INTRODUCTION

CNC, or computer numerical control, is a technique for using a computer to operate industrial tools and machinery. It entails automating the operation of numerous devices, including routers, lathes, milling machines, and more, using both hardware and software.

A set of preprogrammed instructions governs how CNC machines function. The machine is instructed on how to move, which tools to use, and other machining characteristics by these instructions sometimes referred to as G-codes and M-codes. They are a series of alphanumeric codes. Expert CNC software is used to generate these codes.

Accuracy and precision are hallmarks of CNC systems. Their ability to do intricate and multifaceted operations regularly makes them perfect for applications requiring constant quality.

The project revolves around the development of a VB.NET application designed to solve a significant problem in the manufacturing industry, specifically in the operation of CNC or VMC machines. These machines rely on NC files, which are essentially programs that dictate the machine's operations. The generation of these NC files is typically handled by software like Power MILL360.

However, a critical issue arises with the use of Power MILL360. The software assigns the same program number, O1000, to all programs generated for a tool. This uniform program number creates confusion for the CNC or VMC machines, which are unable to determine the correct sequence of programs. As a result, the machines cannot operate as intended, leading to inefficiencies in the production process.

The current solution to this problem is a manual one. Operators must manually change the program number to an ascending sequence for each program. This process is not only time-consuming but also prone to human error, both of which can significantly impact production. Recognizing the need for a more efficient solution, this project was initiated. The goal was to develop an application that could automate the process of generating an ascending sequence of NC files. The application, built using VB.NET, is designed to generate the correct sequence in just a few milliseconds.

In conclusion, this project represents a significant step forward in addressing a persistent problem in the manufacturing industry. By leveraging the power of automation, it offers a practical solution that can save time, reduce errors, and boost production efficiency.

NC file-

In the manufacturing sector, automated machine tools, such as CNC (Computer Numerical Control) and VMC (Vertical Machining Center) equipment, are controlled by NC (Numerical Control) files. These files provide the machine with instructions on how to run in order to generate a certain part or component.

```
%
O1000(MSG, A_10R1_L60)
N1(MSG, DATE, - 17/07/2023)
N2 (DP Version : 1525 & Option File : new HaasVF3-Haas )
N3(MSG, A_10R1_L60)
N4 G90 G40 G80 G49
N5 (TOOL TYPE: TIPRADIUSE)
N6 T1 M06 (TOOL DIA: 10. TIP RAD: 1.)
N7 S4000 M03
N8 G00 G54 X0 Y0
N9 G43 H01 Z10.
N10(MSG, A_10R1_L60)
N11 X0 Y0
N12 Z10. M08
N13 X29.988 Y17.954
N14 Z5.
N15 G01 Z-.299 F500.
N16 X29.713 F1800.
N17 G02 G17 X27.25 Y18.774 I-.002 J4.104
N18 G01 X27.246 Y18.777
N19 G03 X25.601 Y17.955 I-.617 J-.822
```

Fig 1- NC file format

Problem Associated with NC file. -

The use of Power MILL360 software to create these NC files is the source of your issue. The popular computer-aided manufacturing (CAM) program PowerMILL360 is used to write the instructions that operate these machines. Nevertheless, PowerMILL360 gives each program created for a specific tool the same program number, O1000.

This presents a serious issue for VMC or CNC equipment. The program numbers are what these machines use to figure out what order the programs should be run in. The machines cannot determine the correct sequence when all the programs have the same number. The machines might not carry out the programs in the correct order as a result, which could cause operational problems.

Purpose of the Machinist toolkit: NC File Sequence Generator-

The Machinist Toolkit is designed to automate the process of creating NC files in ascending order. This is a reaction to an issue with the PowerMILL360 software, which gives all programs created for a tool the same program number (O1000). This causes confusion for CNC or VMC machines since they can't comprehend the program sequence.

This problem currently has a manual solution. For every program, operators have to manually switch the program number to an ascending sequence. This method takes a long time and is prone to human mistake, both of which have a big effect on output.

In a matter of milliseconds, the Machinist Toolkit will automatically generate an increasing sequence of NC files, hence eliminating the need for this laborious human operation. This not only results in substantial time savings but also lowers the possibility of human error, increasing production process efficiency.

Objectives-

- Automate the procedure for producing an NC file sequence that goes up.
- Change each NC file's default program number (O1000) from PowerMILL360 to a unique number that is arranged in ascending succession.
- Enable CNC or VMC machines to accurately comprehend and carry out the program sequence, which will improve their performance.
- Eliminate the requirement for manual NC file renumbering to save time and boost overall productivity.
- Boost productivity by producing the NC files in an ascending order in a matter of milliseconds.

LITERATURE REVIEW

Regardless of their format—binary or text-based—NC files are crucial to the world of computer numerical control (CNC) and vertical machining center (VMC) equipment, according to our survey. They serve as repositories for intricate guidelines and instructions that detail the precise movements and operations of these machines during the production of various parts and components. The significance of NC files in machining operations cannot be overstated. They are vital in ensuring reproducibility and accuracy, two vital objectives in modern production processes. These files make it possible to fully automate labor- and mistake-intensive tasks that are challenging to do by hand, increasing the productivity and uniformity of production lines.

It's interesting to note that maintaining and sequentially running NC files involves a number of difficulties. A given job may have many NC files associated with it. These files are usually created using Powermill360 or another specialized software. One way to identify these files is that they often have the same program number, which suggests that they are intended to run one after the other. It is a challenge for users to have to manually alter the program numbers in ascending sequence. This manual intervention is labor-intensive and prone to errors if not executed with precision.

The literature that is now available has numerous studies that address the importance of NC files and their application in modern production.

There has also been research done on the challenges of manually tracking program numbers while sequential NC file execution is underway.

It has been established that innovative methods are needed to speed up this process and reduce the likelihood of errors and time.

The areas of efficient NC file management and flawless execution require more study and development. The ensuing sections will concentrate on specific study findings, developments in NC file management, and potential solutions to the time-consuming manual program number changes in these files.

METHODOLOGY & OPERATING PRINCIPLE

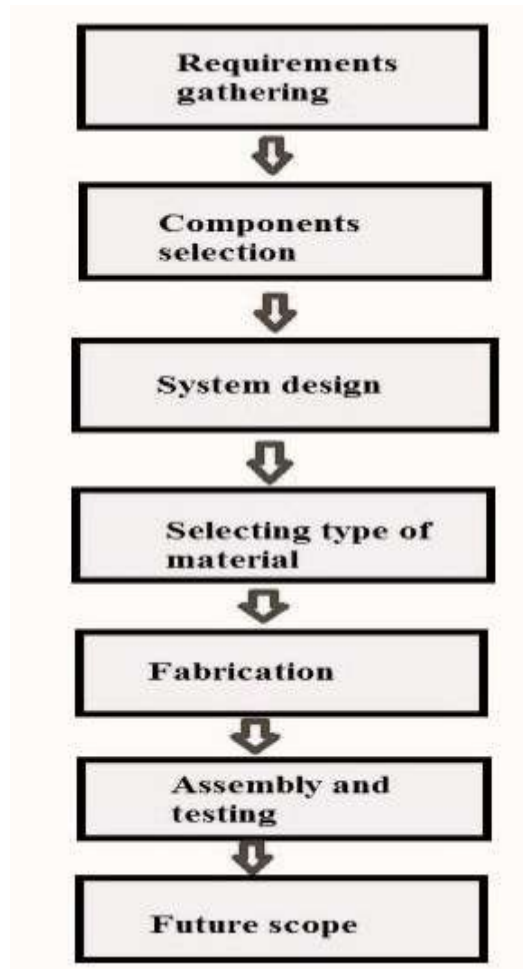


Fig 2- Methodology and operating principle

Block diagram



Fig 3- Block diagram

Output-



Fig 4- User Interface of Machinist toolkit



Fig 5- Validating file selection



Fig 6- Operation completed

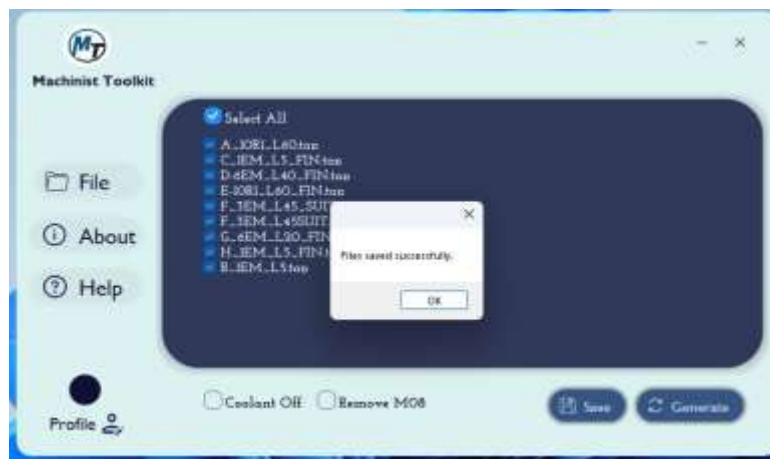


Fig 7- Files saved successfully

Scope

- The application should be accessible, efficient, and able to accurately generate sequences for NC files. It should be user-friendly and available on the Windows operating system.
- It removes the need for manually changing of NC file program number.
- The system may be useful for operators to easily operate CNC machines.

CONCLUSION

The VB.NET project Machinist Toolkit effectively tackles a crucial problem in the manufacturing process that involves CNC or VMC machines and PowerMILL360 software. Your solution lowers the possibility of error and removes the need for laborious human changes by automatically creating an escalating sequence of NC files. This greatly improves the industrial process's efficiency. Your project exemplifies how software solutions can revolutionize industrial settings by increasing productivity, streamlining processes, and eventually improving a company's bottom line.

REFERENCE

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