

# Experimental Study of Setup Time Reduction in CNC Machine Shop

Velliyangiri. J, Dr. Prakash. E, Dr. Anandha moorthy. A

Department of Mechanical Engineering, Bannari Amman Institute of Technology,  
Sathyamangalam, Tamil Nadu, India

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## I. INTRODUCTION

The significance of process duration decrease in CNC machines is should in current world, or, in other words fabricating cost decrease for the focused market. To begin with, numerous organizations are attempting to accomplish Just-In-Time (JIT) benefits. They need each required segment accessible at the point it is required, wiping out the need to stock any of the related parts. Since lessening burn time will enhance through-put of employments, process duration decrease is a noteworthy supporter of any genuine JIT program. Second, diminishing process duration enhances an organization's adaptability. It causes them to run any activity whenever without overburdening setup individuals or machine devices. Third, obviously organizations need to enhance overall revenues. The quicker a creation run can be finished, the more benefit an organization can make. Furthermore, forward, rivalry manages that an organization have the capacity to cite the most minimal conceivable cost. Since most organizations quote employments dependent on a machine's shop rate in Rupees every hour of utilization, they can cite lower (landing more positions) if process duration can be limited i.e. the process duration diminished is immediate benefit made with no capital speculation and lessened work.

## A. Machining process

CNC Manufacturing Workflow has three Categories essentially

## ABSTRACT

The significance of process duration decrease in CNC machines is should in current world, or, in other words fabricating cost decrease for the focused market. To begin with, numerous organizations are attempting to accomplish Just-In-Time (JIT) benefits. They need each required segment accessible at the point it is required, wiping out the need to stock any of the related parts. Since lessening burn time will enhance through-put of employments, process duration decrease is a noteworthy supporter of any genuine JIT program. Second, diminishing process duration enhances an organization's adaptability. It causes them to run any activity whenever without overburdening setup individuals or machine devices. Third, obviously organizations need to enhance overall revenues. The quicker a creation run can be finished, the more benefit an organization can make. Furthermore, forward, rivalry manages that an organization has the capacity to cite the most minimal conceivable cost. Since most organizations quote employments dependent on a machine's shop rate in Rupees every hour of utilization, they can cite lower (landing more positions) if process duration can be limited i.e.- the process duration diminished is immediate benefit made with no capital speculation and lessened work.

- Cycle Time
- Setup Time
- Idle Time

## B. Process duration

Process duration of a machine can be essentially estimated by timing to what extent it takes from squeezing the catch to begin the cycle for the main work piece to the squeezing the following catch for the following work piece. Process duration is characterized to be the time that takes to load, run, and empty on work piece. Creation amounts in an industry manage that the more work piece you run, the more essential it is to accomplish the objective of bringing down the process duration.

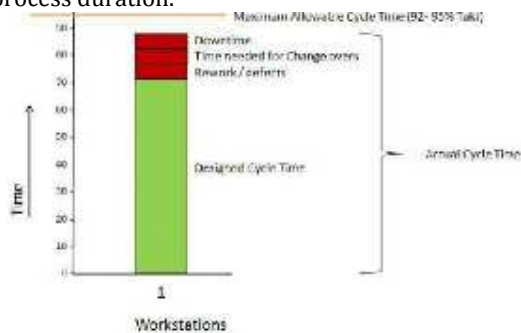


Fig. 1.1 Process duration chart

Process duration has a few Categories fundamentally

- Machining time
- Roughing time
- Finishing time
- Tool changing time
- Tool situating/Tool repositioning time

### C. Machining time

Machining time is fabricating process that includes evacuating materials utilizing cutting instruments for disposing of the undesirable materials from some work piece and changing over it into the shape you want. A substantial bit of stock is utilized for cutting the work piece. The substantial stock may be in any shape, for example, strong bar, level sheet, and shaft or even empty tubes. Machining time is the time when a machine is really handling something. By and large, machining time is the term utilized when there is a decrease in material or expelling some unfortunate parts of a material.

### D. Setup time

The time taken to set up the assembling procedures and framework for generation.

### E. Fixture time

The time required to settling and fixing the apparatus in the work table and taking work balance is called as installation time.

### F. Program age time

The time required to create the program in G codes and M codes for the machining task is called as program age time.

### G. Tool counterbalance time

The time required to check the counterbalance between the device and the work piece is called as device balance time.

### H. Inspection time

Prior to beginning the creation of a part, a model of the segment is produced and it is investigated by utilizing coordinate estimating machine [CMM]. The time taken for assessment of a model segment is called investigation time.

### I. Roughing time

A roughing task is utilized to evacuate a lot of material quickly and to deliver a section geometry near the coveted shape. A completing task pursues roughing and is utilized to accomplish the last geometry and surface wrap up.

### J. Completing time

Completing task is performed subsequent to roughing and its motivation is for the most part to accomplish last geometry. Completing activities in the fast machining methodology used the littlest level end process apparatus to machine the greater part of the shapes present on the part. Summing up the activity utilizing a solitary slicing apparatus figures out how to limit the arranging load and maintains a strategic distance from any highlights acknowledgment errands.

### K. Instrument changing time

The time taken for settling another instrument in the place of existing apparatus from the device magazine is called as device evolving time.

### L. Apparatus Positioning/Tool Repositioning Time

The time required to situating of the apparatus from one point of machining territory to other machining region is called as instrument repositioning time

### M. Device Planning

It is most vital that the instruments are orchestrated in the request in which they are utilized for machining. That implies the instrument that is utilized first should be organized alongside the second one, the device that is utilized as the second one must be masterminded by the third device et cetera. Along these lines, superfluous forward and backward development of the tooling framework is abstained from amid instrument ordering.

Estimation of the devices is most essential to attempt to organize the instruments as close as conceivable to one another before they are utilized. This also is planned to limit any hub developments amid instrument ordering.

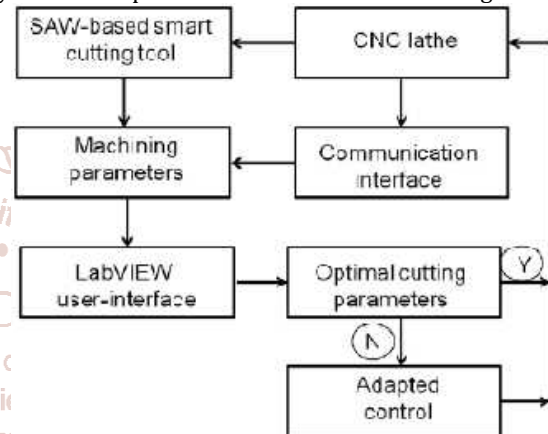


Fig. 1.2 Device planning

### N. Idle time

Inert time is inefficient time with respect to representatives or machines caused by administration or because of components outside their ability to control. Inert time is the time related with pausing, or when a bit of hardware isn't being utilized yet could be. It could likewise be related with figuring, and all things considered, alludes to handling time

### O. Ideal time decrease

Organization chiefs who don't effectively plan work movements or tasks stream may cause inert time. Representatives themselves might be in charge of causing inert time. For instance, if an auto plant gathering group makes 100 autos in an eight-hour move and the quality review and testing bunch forms just 50 autos amid that move, the sequential construction system would need to sit for a timeframe until the point that the quality control amass made up for lost time to pace.

No business keeps running at 100% productivity over significant lots of time. Inert time is inescapable, yet the objective is to limit this "cost" to the organization through watchful planning and coordination with associated gatherings. Additionally, directors can attract up emergency courses of action to keep tasks running when a sudden occasion emerges.

### P. Part change after some time

The time required putting the work piece and cinching it in the installation of machine device after one task cycle finishes is brought part change over the long run.

### Q. Tool substitution time

The time taken for settling an instrument in the turret or device magazine of the machine and bolstering of hardware counterbalance is called device substitution time.

### R. Preplanning time

Before the activity of the work piece is get the opportunity to complete, the work piece for the following task ought to be accessible. Generally is will cause perfect time. This time is known as perfect time because of absence of preplanning time.

#### A Rough Process Plan

Route Sheet	by: R.C. Dhang
Part No. S1243	
Part Name: Mounting Bracket	
workstation	Time(min)
1. Mill Pm	5
2. Mill02	4
3. Drill01	
4. Insp	1

Fig. 1.3 Rough process plans

## II. PROCESS DURATION REDUCTION

To limit the process duration in these zones, there are two manners by which this can be accomplished. The procedure build must choose a suitable machine instrument, cutting apparatuses, fixturing, and machining request in a way that it coordinates the quantity of work pieces to be machined that will be founded on the Generation amount. The process duration will be an impression of the procedures being utilized to machine work pieces.

To upgrade cutting tasks for this would include legitimately choosing cutting instrument materials, feeds, and speeds to machine work pieces as productively as conceivable with the current procedure. The specialist for those machines must not ignore different procedures for they might be so worried about limiting system execution that they disregard different tasks, bringing about serious squanders of process duration. Machining time decrease Machine time decrease are finished by the accompanying advances.

## III. OBJECTIVES

The vast majority of the assembling businesses are have a tendency to flop in accomplishing a large scale manufacturing over a given timeframe almost 50% of the working time taken for the machining task. anyway a considerable lot of the advanced machines, for example, (CNC, VMC) working machines are available at the present situation ,there is the part to the producer upon his diverse methodology prompts higher profitability .our principle saying towards this task is to abbreviate the machining time with the end goal to build high rate of creation with the base expected time .likewise to deliver the chain tensioner segment with superior which would be substantially more steady and consistency towards the current item and to decrease the time by 45% to the progressive of each machined segment.

Enhanced administration of the stream of movement through container necks to limit track inhabitation times. This will be tended to through enhanced time tabling procedures and continuous activity administration to diminish generally speaking postponements through enhanced administration strategies that give strong time tables fit for duplicating with ordinary factual varieties in tasks and minor annoyances. To

diminish by and large postponements and in this way benefit constancy through enhanced movement administration procedures that can recuperate activities following minor irritations and real aggravations.

### A. Nature of cut

Consistent cut like turning, drilling, penetrating and so on are done at higher cutting speed. Stun started cuts in molding machine; arranging machine, opening machine and so forth are directed at lower cutting speed. Irregular cuts, as in processing, tottering and so forth are done at very lower speed for dynamic stacking.

### B. Work material

Harder, more grounded, warm safe and buckle down empower materials are machined at lower cutting speed. Delicate, non-sticky and thermally conductive materials can be machined at moderately higher cutting speed.



Figure 2.1 work materials

### C. Cutting device material

HSS devices are utilized at inside 40 m/min just in turning gentle steel while for a similar work solidified carbide apparatuses can be utilized at cutting speed, 80 to 300 m/min. Superior artistic devices and cBN apparatuses are utilized at fast in machining steels of various quality and hardness. Precious stone pparatuses can be utilized in machining different materials (aside from Fe-base) at cutting speed past 500 m/min.

### D. Cutting Liquid Applications:

Appropriate choice and use of cutting liquid may permit increment in slicing speed by 20 to half



Fig. 2.2 cutting liquid

**E. Purpose of machining**

Harsh machining with substantial MRR is generally done at moderately low or moderate speed. Complete the process of machining with little feed and profundity of cut is normally done at high VC Kind of machining activities Unlike turning, exhausting and so forth the task like threading, reaming and so on. are completed at much lower (20 to half) cutting speed for accomplishing quality complete Capacity of machine device intense, solid, unbending and stable machine instruments permit substantially higher VC, whenever required and allowable Condition of machine tool.

Cutting speed is kept lower than its ordinary esteem stipulated for a given device – work material combine, if the machine instrument is really old or having impediments because of wear and tear, backfire, misalignment, flimsiness and so forth.

The variables that are considered amid choosing the estimation of feed are,

- Work material (type, quality, hardness and so on.)
- Capacity of the machine apparatus (control, unbending nature and so forth.)
- Cutting instrument; material, geometry and arrangement
- Cutting liquid application
- Surface complete wanted
- Type of task, for example threading activity needs huge feed as indicated by the lead of the string.
- Nature of cut; consistent, stun started type, and irregular Feed, which raises cutting powers relatively, is kept low in stun and discontinuous compose cuts.

**F. Roughing time decrease:**

Two unmistakable ways to deal with discover ideal roughing introductions. They are, Additional roughing introduction approach .This methodology includes acquainting an additional machining introduction with the present introduction set. Two strategies are proposed. The first include one roughing introduction that licenses cutting of material until the point when the focal point of the round work piece is come to. To stay away from the development of thin material, the cutting just continues until the point when the perimeter of the conciliatory help chamber is come to. The thick material left will be evacuated later by other roughing tasks. Having these extra roughing introductions is principally in light of the fact that it is conceivable to expel more material and abbreviate the roughing procedure in perceivability introductions.

**G. Part roughing introduction approach:**

Rather than adding to the quantity of introductions, this methodology adjusts the perceivability program yield by taking out the roughing introductions and consolidating them with alternate introductions. Various point mixes are distinguished to chip away at the roughing procedure. The mixes are developed from three and four points that together produce five arrangements of roughing introductions. The blend of three edges is a base prerequisite for roughing tasks without framing any trouble in evacuating slim segments. The purpose behind this incremental esteem is because of the likelihood of thin material development amid the third introduction of the roughing task. In light of this introduction, the device is guided to begin the machining from a slanted position and shapes the part viably.

**H. Cycle time decrease standards**

The two errands composes identified with running creation, the three general approaches to diminish process duration, and the four-advance strategy to decrease process duration

**I. Cycle time decrease methods**

Innumerable strategies to lessen process duration for CNC machining focuses and turning focuses in a few classes, including arrangement and association, work piece stacking, program execution, work piece emptying/emptying, looking after generation, estimating modifications, and dull device substitution

**J. Two Errands Composes:**

We group assignments identified with finishing creation keeps running with the end goal to enable you to approach your process duration decrease program in a consistent way.

**1. On-line errands**

These are errands that add to the length time it takes to finish the generation run. Clear precedents that happen in each cycle incorporate work piece stacking, program execution, and work piece emptying. Models that don't happen in each cycle can incorporate device upkeep, examining examinations (if the machine is down amid assessment), and administrator individual time.

**2. Off-line undertaking**

These are errands that don't add to the time allotment it takes to finish a generation run. Basically, these are undertakings that happen related to (or inside to) the CNC machine's program execution. Precedents incorporate measuring acclimations to balances (ideally you concur that Offsets can be balanced while the machine is running), work piece cleaning, work piece de-burring, and crude material readiness.

**3. Setup time decrease:**

While a CNC machine is in setup, it can't be creating any work piece. This non- beneficial time can never be recuperated. Everybody says they need to decrease setup time. In any case, the more setups you make, the more vital it is to achieve this objective - and the more you ought to will do to lessen setup time.

Decrease of machine setup time utilizing the SMED technique is modest, yet has just constrained impacts. The structure of another machine is costly, however the new setup time will be short. Considering the two expenses and setup time, it is most proficient for the organization to choose the SMED strategy and to make enhancements to the machines.

Single-minute trade of kick the bucket (SMED) is one of the lean creation strategies for decreasing waste in an assembling procedure. It gives a quick and proficient method for changing over an assembling procedure from running the present item to running the following item. This quick changeover is critical to lessening creation parcel sizes and consequently enhancing stream (Mura), diminishing generation misfortune and yield changeability. So we can accomplish single moment trade of bite the dust by utilizing zero-point clipping framework.

**4. ZERO POINT CLAMPING SYSTEM**

The zero-point bracing framework is a development framework to lessen the setup time z. This measured

framework meets the prerequisites of particular arrangements with the most ideal usage of machine limit. In spite of the fact that the machine apparatus needed to stop for the set-up time up to this point, the work piece would now be able to be clipped and situated on the bed outside the machine device. The set-up time is currently just constrained to stacking and emptying the bed, which occurs like a flash. In the event that various assembling forms are fundamental for machining, at that point the bed including the work piece can be utilized without zero-point misfortune.

Like the system that grasps revolving apparatus holders on many machining focuses, zero- point cinches utilize a mounting handle and clipping wedge bolt to pull a bed, installation or other work holding gadget—or even the part itself— against the ground face of a zero-point hurl. The maintenance handle sits inside the throw bore and offers positional exactness to inside a couple of tenths of an inch and a few tons of clipping power until discharged through mechanical, water driven or pneumatic weight.



Fig. 3.1 Zero clamping system

## 5. Features

Referenced clasping of apparatus components to situating at the "zero point" with immaculate repeatability. Takes into account the machining of work pieces in a few work ventures on various machines. Up to 30 KN of maintenance drive.

- Mechanical, pneumatic and water driven incitation.
- Anti-turn locking gadget when utilized with individual components.
- Superior effectiveness, repeatability and cost reserve funds.
- Suitable for use on all machines.
- Increased profitability

## 6. Advantages

Free machine limit through decrease of setting up time by up to 90% Minimum cleaning and support work without zero-point misfortune because of clipping instrument outwardly Highest accuracy Repeatability of 0.002 mm more than 750,000 clasping forms through padded, tapered centering with leveling framework No zero point moving because of pay for warm extension Increased process unwavering quality Large pre-centering for solid encouraging of the beds

additionally with programmed stacking Air-stream framework for cleaning and checking the levelling framework.

## 1. Tool offset

This capacity is accomplished by moving a predefined instrument along the control pivot. The machine must be educated the sum the machine zero and part zero point. The part of balance between zero points is the beginning stage of the machining activity on the work piece at X, Y and Z hub.

## 2. Tool pre-setter

The vast majority of the CNC machines have no worked in apparatus estimation instrument, so to quantify CNC machine devices outer device estimating gadgets are utilized. These apparatus estimating gadgets are called Tool Pre-setter. To accomplish exact apparatus estimations a CNC machine workshop must have a CNC Tool Pre-setter.



Fig. 3.4 Tool pre setter

## 3. Selecting tool pre-setter

While choosing a device pre-setter, it is imperative to think about the most extreme device length (z-pivot) and distance across (x-hub) that will be estimated. This thought is essential in deciding the movement limit of the device pre-setter and whether it will quantify the total scope of instruments utilized. Other critical contemplations incorporate the resiliences permitted to the device pre-setter. Regularly, exactness inside 0.0001" is accessible.

Device pre-setter are accessible in two principle composes

- A. Contact device pre-setters
- B. Non-contact device pre-setters

### A. Contact tool pre-setters

This utilization a touch test that contacts the device to make estimations. This kind of hardware pre-setter has an exactness of under 0.0005".

### B. Noncontact tool pre-setters

Noncontact instrument pre-setters utilize shadow charts to give a device profile view to review and pre-setting. These pre-setters may quantify device length and distance across, compute nose radii and points, and identify harmed front lines. Very exact, noncontact device pre-setters can normally position inside 0.000040". This sort of hardware pre-setter is regularly prescribed for PC incorporated assembling frameworks and cells and in apparatus room administration frameworks.



Fig. 3.7 Non-contact pre setters

### C. Advantages

Apparatus pre-setter makes the CNC mechanic life simple engineer simply need to fix the instrument in apparatus holder after this he takes the device estimations from the device pre- setter and simply put them straight in CNC machine device geometry. Pre-setters spare setup time and lessen machine downtime costs, while expanding device setting exactness.

### D. Tool offset measurement system equipped inbuilt in the machine:

Laser estimating framework for CNC machine instruments that is interesting worldwide for non-contact device estimation and apparatus checking under the harshest conditions. Phenomenally quick, exact and dependable advantage

- Automatic estimations convey extraordinary time reserve funds.
- No blunders because of manual instrument setting utilizing measure squares.
- No composing blunders and relating ensuing harm.
- Automatic computation and revision of the apparatus balance.
- Automatic apparatus breakage location between the machining cycles.
- No harm because of undetected device breakage.
- Enable low-kept an eye on activity.
- Realise persistent process chains.

Quality from the worldwide market pioneer in laser estimating innovation for machine apparatuses.

### E. Fixture changeover optimization

The second changeover activity that is enhanced is that of appending and separating the installations. Overall it takes 3.08 minutes to evacuate one installation and connect the following apparatus. Since there are two tables for each machine, this implies joining and isolating installations requires 6.16 minutes for every changeover. The objective of this area is to limit the quantity of installations that should be appended and confined from the machines. The apparatuses contrast from the instruments in that when an installation is expelled it is constantly supplanted by another. With the instruments, it was important to discover what number of

apparatuses were evacuated and connected in light of the fact that the quantity of devices being joined was not generally the equivalent as the quantity of devices being expelled. Thusly, on account of the installations it is just important to check what number of apparatus changeovers happens for the predefined employments.

It was discovered that upgrading the quantity of installation changeovers yields better results than advancing apparatus changeovers. In this manner, the organization being considered is encouraged to bunch the occupations as indicated by the apparatuses that are utilized

## IV. METHODOLOGY

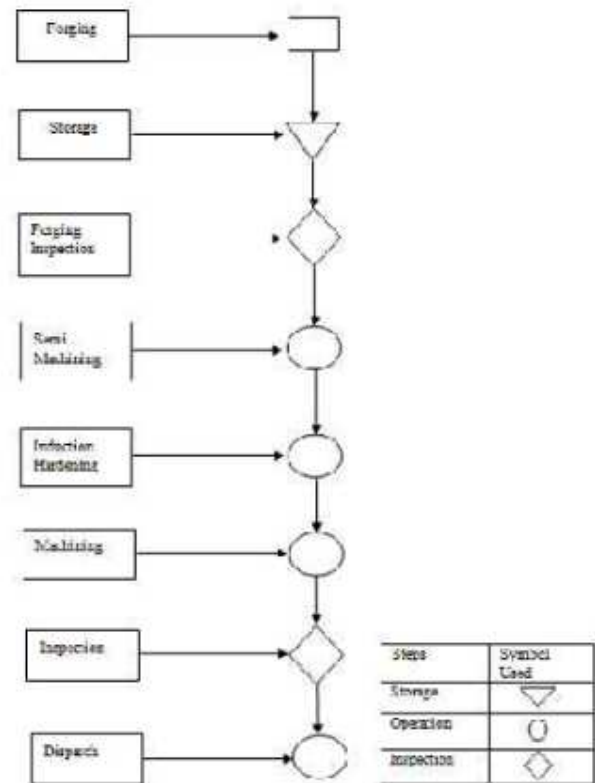


Fig. 4 flowcharts for machining

The study deals with the machining time and cycle time reduction using offline fixture to improve machining time and idle time should be reduced. So improve to company profit and worker utilization.

## 4. CONCLUSION

This exploration has investigated three different ways to lessen changeover times for CNC Processing machines at a modern assembling organization. To start with, the SMED Approach was utilized to break down the present changeover process and another Changeover approach was proposed. Next, two techniques were produced all together to tackle the particular issues clear with the organization being examined. The first Technique is to for all time match the segments of an item with the goal that they are produced amid a similar era. This will cause every one of the segments for an item to achieve the gathering region amid a similar era. The second technique was produced to put occupations with comparable changeover qualities beside one another on the calendar. This lessens the quantity of hardware and installation changeovers required amid a given booking period.

This exploration broke down six changeovers on bed changing CNC processing machines. It was discovered that the normal changeover time was 57.23 minutes; 72% of which was done inside. Another changeover technique was produced to augment the administrator's time by using inert time discovered amid cycle changeovers and preliminary runs. At the point when connected to one of the broke down changeovers it was discovered that the inner time was decreased by 38%. It was additionally discovered that the proposed changeover strategy can be utilized as a standard work sheet for all changeovers.

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