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Research Paper

Applications Use of Coordinate Measuring Machine (CMM) for Measurement Products Multi Function at PT. Mepopuspitekserpong, Tangerang

Sutarman[1], Haryonoedihermawan[2], Dede Farhan Aulawi[3]
LPPM Prodi Teknikinformatika STMIK Trigunautama
Jl. MH. Thamrinkomplekmahkota Mas Blok E No. 28-30 Cikokoltangerang

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Abstract: *Coordinate Measuring Machine (measuring machine coordinates) is a measuring device multi-function high-speed (hight speed) the accuracy and efficiency in a high measurement, the working principle of Coordinate Measuring Machine CMM opposite of Computer Numerical Control CNC, the CNC machine coordinates that generating inserted chisel movement on the axes X, Y and Z on the workpiece, while the CMM contact between the probe with the workpiece to produce coordinates. In addition, if the CNC machines use ball bearings circulating (Circulated ball bearing) then the machine CMM using the annulment of air (air pad bearing) so movement is very smooth, to ensure the accuracy of construction CMM is made of rigid once One way to use a table grader made of granite as the reference plane. Cordinat Measuring Machine is measuring multi-function tools hight speed and accuracy and efficiency in Measuring result*

Keywords: *Cordinat Measuring Machine, Multi-function Measusuring, Product*

Preliminary

Cordinat Measuring Machine is an instrument used to measure the three-dimensional (3D), the dimension measured is the room that has length, width and height, which translates into a Cartesian coordinate system X, Y and Z. Then the coordinate data measured by CMM converted into measurement data such as position, diameter, distance, angle, etc. In simple terms how the CMM is read changes in the position of a zero reference origin point of a part that is measured or the origin of the machine itself. Changes in position are then recorded and processed into measurement data using software that is included in CMM.

CMM is a multi-function gauge high speed measurement accuracy and efficiency is also high, in principle, CMM is the opposite of the CNC, the CNC coordinates entered chisel generate movement on the axes X, Y and Z. While the CMM contact between the probe with the object coordinates the work produces. In addition, if the CNC machine using circulating ball bearings (Circulated ball bearing) then the CMM machine using the annulment of air (air bearing pad) so movement is very smooth. To ensure the accuracy of the CMM made very rigid construction. One way to use the granite as a table or a field reference.

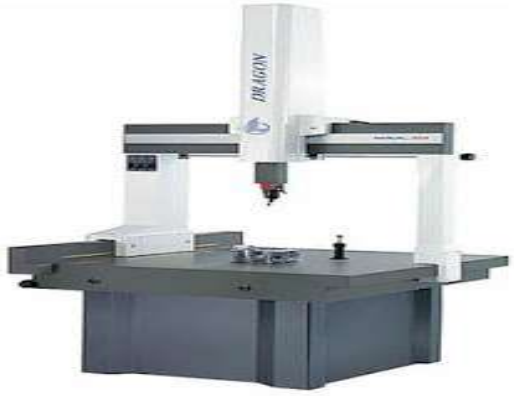

Figure 1. Computer Measuring Machine CMM

Component parts CMM Unit

CMM 3D component consists of several main parts that relate to and affect the accuracy of these machines, these parts are:

1. Working Table, a place to put the part to be measured. The average is made of granite.
2. Support, is a foot to bear the whole burden of CMM. Some CMM equipped with air dampers to reduce the effects of vibration generated around CMM environment.
3. Air bearing, bearing CMM uses water as the foundation for the movement of all axes.
4. Axis Guideways, was a track or path all axis to move, have direct contact with the water bearing. Average material made of aluminum there is also the use of granite, for engines with higher accuracy using ceramic materials.
5. Motor, is a unit to move the axis, specifically for motorized automatic machine or simply use a joystick.
6. Joystick, an operator control panel for easy operate the machine.
7. Controller, has a variety of functions including; the interface between the engine and the PC, the motor driver as a resource for the movement of the motor, a data storage for storing files or programs mover CMM correction, ADC and DAC, etc.
8. Probe Head, functioning as a trigger for the CMM to record the coordinates of the position of part touches (touch points). Some CMM equipped with non-contact Probe Head to get a lot of touching points that can reach hundreds or even thousands of points for the purposes of CAD / CAM. For touching part can not be directly touched to the part but have to go through an intermediary that serves as a feeler stylus.
9. Sensors. CMM has many sensors to improve its accuracy; The sensors include; temperature sensors, overcurrent sensors, limit switches, home position sensor, water pressure sensor, reading head.
10. Linear Scale. This unit as a transducer to convert the position change into current or voltage and then using the software into the data coordinates X, Y and Z.

Excellence CMM

1. Coordinate any of the workpiece can be determined easily
2. high measurement precision
3. The data processing unit can process data quickly and directly printable
4. Time setting short measurement

CMM Coordinate Measuring Machine is a 3D device for measuring the physical geometrical characteristics of an object. This machine can be controlled manually by the operator or a computer controlled. CMM measuring process on the machine defined by a probe attached to the axis and 3-dimensional moving on this machine. Probes may be mechanical, optical, laser, or white light. In principle, the CMM is the opposite of the CNC (Computer Numerical Control). At CNC coordinate entered machining process produces movement in the X, Y and Z. While in contact CMM Cantara probe with the workpiece to produce coordinates. In addition, if the CNC machine using circulating ball bearings (Circulated ball bearing) then the CMM machine using the annulment of air (air bearing pad) so movement is very smooth. To ensure the accuracy of the results pemgecekan, construction CMM made very stiff (rigid). One way to use the granite as a table or a field reference. Determining the CMM specification is very important to match the workpiece with the CMM capabilities.

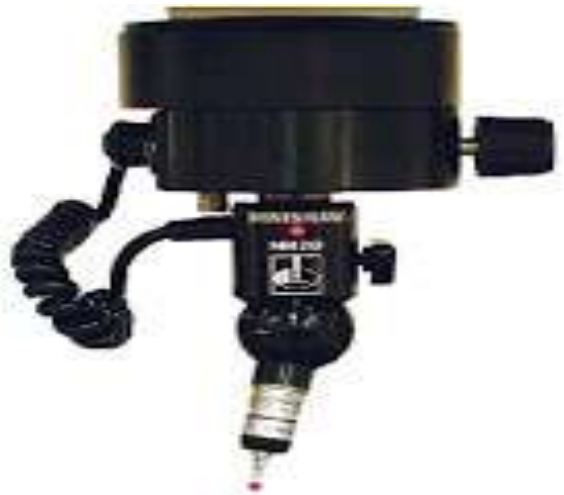

Figure 2. Frobe

The capacity of the CMM is the maximum size of the object or workpiece where CMM machine can accommodate. A CMM must have sufficient capacity to match the size of the objects the user needs to measure. Measurement speed is the rate at which the CMM can read the position and make measurements. It probably refers to the speed of imaging probes, or for the overall measurement process, which is also a function of the type of control (CNC be faster than manual control). CNC (Computer Numerical Control) or Direct Computer Computer (Direct Computer Control) is a control system that is built on the CMM to control the movement of the probe. CNC-CMMS is best suited for production environments that require higher volume measurements, and also in applications requiring complex measurements and small with fine features.

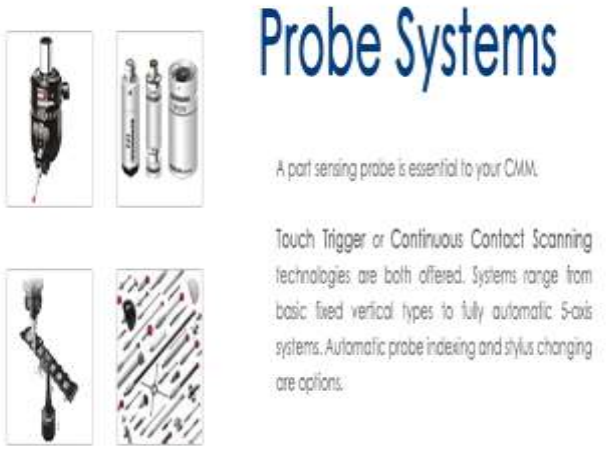

Figure 3. Accesoris Probe System CMM

3D CMM Component

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9. Sensors. CMM has many sensors to improve its accuracy; The sensors include; temperature sensors, overcurrent sensors, limit switches, home position sensor, water pressure sensor, reading head.

10. Linear Scale. This unit as a transducer to convert the position change into current or voltage and then using the software into the data coordinates X, Y and Z.

11. Software. Program is a liaison between the user of the machine.

rinciples Probe

optical probe / laser probe can be used for measuring microscopes or multi-sensor measuring machine. Fringe projection systems, theodolite triangulation systems or laser distant and triangulation system, which is not called measuring machines, but the result of the measurement is the same point in space. Laser probes used to detect the distance between the surface and the reference point at the end of the kinematic chain can use the function interferometrical, variations in focus, the deflection of light or shadow beam principle.

Probe Systems New Models

Probe newer models that have probes that drag along the surface of the part taking points at specified intervals, known as scanning probe. Method of CMM inspection is often more accurate than the conventional method of touch-probe and most times faster as well.

The next generation of scanning, known as non-contact laser scanning include high speed triangulation point, [3] scanning laser line, [4] and white light scanning, [5] developed very fast. This method uses either laser or white light projected on the surface of the part. Thousands of points can then be retrieved and used to not only check the size and position, but to create a 3D image of the part as well. "Point-cloud data" can then be transferred to CAD software to create 3D models of the work piece. Optical scanners often used on parts of soft or delicate, or to facilitate reverse engineering

Understanding CMM in Industrial Engineering as follows:

1. Definition Measurement is the process of comparing the size (dimensions) that is not a standard diketahuiterhadap certain size. Measurements in a general sense is to compare the magnitude of a quantity with a reference or comparison (reference) measurement process will produce a number followed by the name of the magnitude of this reference.

Measurement is a quantitative comparison between a standard predetermined by the object is measured. Standard comparator must have the same properties as the object is measured and defined by the International Organization for Standards ISO, NBS, JIS, SAE, and so on. Coordinate Measuring machne (CMM) is a modern geometric measuring tools by using computers to control the movement of the sensor relative to the measuring object as well as to analyze the measurement data. CMM is an installation to measure different types of measurements using the direction of X, Y and Z. In outline, the construction CMM is divided into 3 parts:

1) Unit machine
2) Installation data processing machines (PC / softwear)
3) Probe (touch probes, probe copy, un-direct probe, etc.

2. Function In principle CMM measuring devices (Faro Arm) is the opposite of the CNC. At CNC coordinate entered generate chisel movement (blade) on the axes X, Y and Z. While the CMM contact between the probe with the workpiece to produce coordinates. In addition, if the CNC machine using circulating ball bearings (Circulated ball bearing) then the CMM machine using air cushion (air bearing pad) so movement is very smooth.

To ensure the accuracy of the CMM construction made very stiff (rigid). One way to use the granite as a table or a field reference.

3. The meter is the key of the process of mass production. Without measuring tools, machine elements can not be made sufficiently accurate to be able to exchange (interchangeable). At the time of assembling, which assembled components must fit each other. At this time, the measuring instrument is an important tool in the machining process from initial manufacture through quality control at the end of the world produksi.di manufacturing industry is not biased separated from the use of measuring instruments, from the most simple (manual) to the already using high teknogi

Description and operation of CMM

1. Description of CMM and operation in practice, orthogonal Cartesian coordinate system, required to achieve danmengukur each position in 3-dimensional space in the measurement range, adalahpaling often achieved by an arrangement of three straight translation lurussumbu with a linear scale. Figure 1.1 shows an example of CMM umumstruktur. For reasons of efficiency, some machines equipped with an extra rotary axis.

2. Schematic CMM most important component is displayed. Basic CMM table formed by the workpiece to be measured is placed. CMM axis is set in this table. Each axis CMM consists of a guideway, a carriage which can move along the guideway, and measurement systems. For accurate motion along guideways, most modern trains have air bearing CMM. The position of the train on the particular axis accurately indicated by a linear scale attached to each guideway. Readings from all three scales together show 3D'position probe is connected to the axis of the latter. This probe is used to set measurement points on the workpiece. Depending on the kind of oversight, CMM can be equipped with a propulsion system consisting of a motor and transmission. CMM can be manually controlled, joystick controlled or Computer Numerical Controlled (CNC). With no manual controls

available drives. Float free to move to different positions on the workpiece measurement, CMM axis joystick control as well as servo-controlled motion command for each axis are given by the operator using a joystick. This last method is the most efficient, because the same measurement can be repeated automatically. In addition to high accuracy can be achieved, because the measuring points can be taken with a well controlled way.
3. Characteristics of the control and measurement accuracy for high-level effects of possible sources of error in the accuracy of the CMM, the attempt to eliminate the errors that affect the mechanical structure have resulted in principle on the conditions for the design and operating conditions:
1) high production and adjusting accuracy.
2) high component stiffness, low mass and good temperature properties.
3) AC Environmental temperature and a small internal heat source.
4) vibration isolation and well-defined when it detects motion.

Several factors can be identified that affect the measurement cycle (see Neumann 1993):
1) crosses and measure the speed, acceleration / deceleration, distance approach.
2) When the probe is changed, the angular speed of rotation table
3) calculation, the data storage time, the output of measurement results
5. Operating and measuring strategy first group of factors should be viewed in relation to the measurement accuracy of the relationship between the factors - factors that affect the speed and accuracy of dynamism is highly dependent on the measurement procedures used. Measurement task itself are basically two types of measuring tasks can be distinguished, namely:
1) Dimensions and profile measurements. dimensional geometry parameter indicates the size of some part of the object to be measured such as length, diameter, distance, etc. corner.
2) Measurement profiles form a specific part of the object is identified. An example is the diameter of the gear and measuring Neither a limited amount of single points measured on the assumption that the geometry elements of the ideal, the parameters are calculated that defines the geometry of this, or point - the point is measured to identify the `real 'geometry of the element that is scanning, using filtering techniques, profiles and dimensions can be calculated of collecting data point.

Steps of Minimize errors

Position (probe) is quite different from machine tools, which are programmed position must be achieved precisely by applying compensation measurement results to fault probe position, position control is not required in addition to favorable compensation for the error dynamic can also be applied in the manual, it is very prone to error dynamic for checking on manual CMM is often done in a way that is less restrained.
Excellence in research objects, dynamic errors for axis acceleration and deceleration, in order to achieve error compensation software to develop such a software compensation method for dynamic error, this research aims at increased efficiency. With the compensation method is faster and possibly without degradation of accuracy in measurement.

The approach used is a combination of analytical and empirical following steps:
1) Identify significant dynamic errors of CMM components.
2) Use extra sensor for the measurement of dynamic errors.
3) Using a model for dynamic linking errors to the input signal from the sensor and measure the impact of all errors identified in the probe position.
4) The measurement results for the mistakes that have been calculated. The first understanding of the dynamic behavior of the CMM must identify the components for dynamic significant errors and their effects on the position of the probe on probing, to be estimated for the estimation, the input signal and the associated model dynamic error for the input signal required.

Operation is defined by kinematic models of the CMM. Next kinematic models used will be presented. In the dynamic part of the parametric errors. Kinematic modeling errors kinematic errors of CMM Model defines the spatial relationships between components of the machine and probe position.

modeling purposes

The purpose of modeling is the estimation of the actual position of the probe. The position of the probe of the CMM is nominally described by the relative position of the machine coordinate system shown with its scale. Real probe position, but was affected by errors in location due to structural deformation of the circle by several sources of error.

parametric error for each axis, the kinematic models describing the relationship between the relative location of the error in the coordinate frame attached to the elements of the machine and the error in the position of the probe, so that a well-defined coordinate frame the choice of location is important.
According to Slocum, 1993, "An important consideration is the fact that the angle error is not affected by other error so that they can be defined with respect to each set of axes. translation errors, on the other hand, is caused by the direct linear motion of the elements as well as the resulting linear motion of Abbe offset ".
modeling steps related to errors in the measured value to the dynamic loads on the CMM. Shows how the rotation and translation errors can be explained, by expressing the deformation in a parametric errors. One part of a structural loop type gantry CMM studied.

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