

Description

Title of Invention: CENTRALIZED PROCESSING CONTROL SYSTEM

Technical Field

[0001] The present invention relates to a centralized processing control system capable of remotely managing an NC program of each machine device with a unified communication scheme (language) and macro variable name for each machine device and a processing line constituted by a plurality of machine devices that are adapted to be CNC-controlled by NC programs of various different communication schemes (languages) and macro variables.

Background Art

[0002] In a processing line at a processing site, one processed article is molded through processing processes using a plurality of machine devices such as NC devices and industrial robots adapted to execute computerized numerical control (hereinafter, referred to as "CNC" or "CNC control"). In the related art, CNC devices of a plurality of machine devices used in such a processing line control the machine devices by numerical control (NC) programs each having a unique communication scheme (language) and a macro variable (macro variable name), and at an actual processing site, machine devices having different communication schemes (languages) and macro

variable names are arranged and replaced for each kind of processing, and processing corresponding to each machine device is sequentially executed, thereby producing a final processed article.

[0003] However, since machine devices have different communication schemes (languages) and macro variable names to be applied to CNC devices for each manufacturer, for example, it is necessary for users to cause programming or orders (commands) to be executed in accordance with connected machine devices, and in the related art, it is difficult to remotely manage, in a centralized manner, a processing line where a plurality of machine devices manufactured by different manufacturers are sequentially used for each processing process to produce final processed articles.

[0004] The inventors have considered that in a case where the next-generation IoT society is promoted, in particular, it is essential to construct an operating system that manages different NC programs in a unified manner in consideration of a potential need to comprehensively and remotely manage accuracy, time, and cost of each processing process and accuracy, time, and cost of entire processing processes by freely combining a plurality of different machine devices at processing sites in plants as well.

[0005] On the other hand, although techniques for managing processing lines in a centralized manner by

using a plurality of CNC-controlled machine devices as in Patent Literatures 1 to 5 and the like have been proposed in recent years, these are just techniques of correlating previous and following processing processes or techniques that propose centralized management within the same communication schemes (languages), specific methods have not yet been established although some techniques indicate capability of managing different communication schemes (languages), and it is still difficult to realize centralized and unified remote processing management.

Citation List

Patent Literature

[0006]

Patent Literature 1: Japanese Patent Laid-Open No. 2000-317775

Patent Literature 2: Japanese Patent Laid-Open No. 4-63652

Patent Literature 3: Japanese Patent Laid-Open No. 2003-295920

Patent Literature 4: Japanese Patent Laid-Open No. 2021-92855

Patent Literature 5: Japanese Patent Laid-Open No. 2021-96498

Summary of Invention

Technical Problem

[0007] The present invention was made in view of the above circumstances, and an object thereof is to provide a centralized processing control system capable of remotely managing an NC program of each machine device in a centralized manner in each machine device and a processing line constituted by a plurality of machine devices adapted to be CNC-controlled by NC programs of various different communication schemes (languages) and macro variables, by complementing calculation with the NC program of each machine device while saving past data in a centralized manner with a unified communication scheme (language) and macro variable name, and on the basis of this, providing specific writing and reading requests to a CNC control device of each machine device.

Solution to Problem

[0008] In order to achieve the above object, the present invention provides a centralized processing control system that externally monitors and manages CNC control devices, with which machine devices operating by various NC programs are able to communicate, in a unified manner regardless of communication schemes and variables,

the centralized processing control system being configured such that

a communication scheme and variable correspondence table indicating the communication schemes and macro variable names of the NC programs corresponding to the

machine devices and the CNC control devices and a unified communication scheme and macro variable name corresponding to the centralized processing control system is stored and updated, and

once a request for reading operation information of an arbitrary machine device is provided, the centralized processing control system determines a communication scheme and a macro variable name in accordance with content of the request for reading and the machine device from the communication scheme and variable correspondence table, transmits an instruction to call a macro variable determined by using the determined communication scheme to a CNC control device of the machine device of the request for reading, and outputs a response numerical value of the macro variable called in response to reception of the instruction as a response numerical value of the unified communication scheme and macro variable name from the communication scheme and variable correspondence table.

[0009] The centralized processing control system of the present invention has a major feature in that attention is paid to communication schemes (languages) of the machine devices to be CNC-controlled and various macro variable names that determine control modes, a unified communication scheme (language) and macro variable name that can be compared to the communication schemes (languages) and the macro variable names are set, and the

unified communication scheme (language) and macro variable name and the communication schemes (languages) and the macro variable names of the machine devices are managed in a comparable manner by a correspondence table (managed by the "communication scheme and variable correspondence table" of the present invention), thereby leading to a development to a mechanism that provides an operating system capable of performing writing on the CNC device of each machine device by temporarily using the unified communication scheme (language) and macro variable name as bridging tools on the basis of the correspondence table (a) to call operation information of the machine device and translate it into the communication scheme (language) and the macro variable name of the bridging tools or (b) to perform translation from the bridging tools into the communication scheme (language) and the macro variable name of the machine device.

[0010] First, according to the centralized processing control system of the first invention, the calling of the operation information of each machine device in (a) is provided. Specifically, the communication scheme and variable correspondence table (see Figure 3, which will be described later) listing correspondences of the communication schemes (languages) and the macro variable names of the NC programs corresponding to the machine devices and the CNC control devices with the

communication scheme (language) and the macro variable name as unified bridging tools corresponding to the present centralized processing control system is set, and once a request for reading operation information of each machine device is provided in the communication scheme (language) and the macro variable name of the present centralized processing control system as the bridging tools, translation into a communication scheme (language) and a macro variable name in accordance with the machine device is performed from the communication scheme and variable correspondence table, and an instruction to read operation information of a CNC control device of each machine device is provided.

[0011] In this manner, it is possible to read operation information of various machine devices merely by providing a request for reading with the unified communication scheme (language) and macro variable name, and it is possible to remotely monitor each machine device in a centralized manner even for a processing line or the like formed of a plurality of machine devices having various NC programs. Here, although the NC programs are generally programs for controlling machines by numerical control, are used mainly by machine tools, robots, and the like, and mean indications and the like of positions, speeds, accelerations, and the like within the programs, the NC programs in the present specification mean control programs related to NC

technologies including computer numerical control (CNC) capable of performing more complicated processing and system integration. For example, the NC programs also include a programmable logic controller (PLC) that issues a stop indication at the time of abnormality during operations of NC machines and manages a flow and safety of the entire processing process, a programmable machine controller (PMC) that controls sensors and actuators, and once NC programs start operations in precise processing, adjusts an operation sequence of the entire system to manage inputs and outputs, and the like.

[0012] In the centralized processing control system of the present invention,

once a request for writing operation information of an arbitrary machine device is provided, the centralized processing control system can determine a communication scheme and a macro variable name in accordance with content of the request for writing and the machine device from the communication scheme and variable correspondence table, transmit an instruction to write a numerical value in a macro variable determined by a communication scheme determined in accordance with a CNC control device of the machine device of the request for writing, and in a case where the machine device of the request for writing permits or refuses the instruction and a response signal thereof is received, output a fact of permission or refusal as the unified communication scheme and macro

variable name in the communication scheme and variable correspondence table.

[0013] In other words, the centralized processing control system of the present invention provides a specific method of performing translation into a communication scheme (language) and a macro variable name of each machine device from (b) the bridging tools described above and performing writing in the CNC control device for the machine device. Although the present invention described above provides a so-called reading function of reading operation information of machine devices having various communication schemes (languages) and macro variable names merely by providing a request for reading in the unified communication scheme (language) and macro variable name using the communication scheme and variable correspondence table, this present invention has a function of providing an instruction for operations at the machine devices having the various communication schemes (languages) and macro variable names merely by providing a request for writing in the unified communication scheme (language) and macro variable name using the same communication scheme and variable correspondence table.

[0014] Therefore, it is possible to perform operation control for each machine device by remotely monitoring the machine devices in a centralized manner with the same language and reflecting the monitoring result even for a

processing line or the like formed by a plurality of machine devices having NC programs by combining the aforementioned reading function. In this manner, it is possible to cause remote monitoring and management of monitoring processing in the previous process and reflecting the processing results to processing in the subsequent process (following process) in real time to be executed in a centralized manner with a unified language even for a processing line in which machine devices that are operated by mutually different NC programs execute a plurality of different processing processes, for example, and it is possible to significantly contribute to promotion of IoT at processing sites.

[0015] Here, as an example of the present invention in which processing in the previous process is monitored and the processing results are reflected to processing in the subsequent process in real time, a specific configuration of executing correction of shape information of a processing target such as dimensional correction or correction of a processing condition for another processing apparatus used in the subsequent processing process in accordance with the processing results in the previous processing processes will be provided below.

[0016] Specifically, it is preferable that in a case where correction of shape information of the processing target such as dimensional correction or correction of a

processing condition is executed, the centralized processing control system be configured such that

once an operation process of one machine drive ends, the centralized processing control system stores the one machine device, the operation process, and measurement positions and measurement values of a processing target and the processing target after processing in an associated manner as previous process measurement data, and

when a different machine device that is to be caused to operate after the operation process of the one machine device is caused to operate,

the centralized processing control system determines a communication scheme and a macro variable name related to correction of shape information (for example, a change in a dimension, surface roughness, roundness and the like) or a processing condition (for example, a change in cutting tool, processing time, processing speed, and the like) in accordance with the different machine device defined or selected in advance from the communication scheme and variable correspondence table by using the correction of the shape information or the correction of the processing condition of a processing target as the request for writing for the different machine device defined in advance on the basis of a measurement value calculated by retrieving a measurement value stored as the previous process measurement data or the different

machine device changed on the basis of the measurement device, and transmits an instruction to write a numerical value in a macro variable determined by a communication scheme determined for a CNC device for the different machine device.

[0017] The present centralized processing control system can select a machine device (select a processing device or the like defined in advance or change the processing device or the like) such as a processing device to be used in the following process in consideration of the shape information such as the dimension measured after the previous process ends when the processing moves on from the previous processing process (previous process) to the subsequent processing process (following process) in the process line, and correct the shape information of the processing target input to the machine device to be used in the following process and the processing condition such as a cutting tool. In a specific example, the present centralized processing control system measures the dimension of the processing target at predetermined measurement positions in advance after the previous process ends, causes an external device or the like to store the machine device (machine tool or the like), the processing process, the processing target, the measurement positions, and measurement values of the dimension in an associated manner in the communication scheme (language) and the macro variable name related to

the dimensional correction of the present centralized processing control system, searches (retrieves) the associated data (previous process measurement data) when the processing target is input or attached in the following process, converts numerical values calculated as measurement values of the dimension of the processing target to be input to the following process into the communication scheme (language) and the macro variable name related to the dimensional correction of the CNC device for the following process, and writes the converted numerical values in the macro variable related to the dimensional correction in the NC program for the following process. In such dimensional correction, there may be various differences in how much dimensional correction calculation to be executed by the NC program of the machine device is to be complemented and in what stage calculation processing for the dimensional correction is to be executed in the present centralized processing control system, and for example, the following dimensional correction examples are listed.

[0018] Specifically, in a first dimensional correction example (dimensional correction 1),

the centralized processing control system is configured such that

when a different machine device that is to be caused to operate after the operation process of the one machine device is caused to operate,

the centralized processing control system determines a communication scheme and a macro variable name related to dimensional correction in accordance with the different machine device from the communication scheme and variable correspondence table by using the dimensional correction of a processing target as the request for writing for the different machine device on the basis of a measurement value obtained by retrieving measurement values in a previous process from the previous process measurement data and averaging the values, and transmits an instruction to write a numerical value in a macro variable name determined by a communication scheme determined for the CNC device of the different machine device.

[0019] In the first dimensional correction (dimensional correction 1) example, the present centralized processing control system retrieves (searches for) the measurement values of the dimension of the processing target after the previous processing from the previous process measurement data obtained by measuring the dimension of the processing target after the processing in the previous process and stored, and provides a request for writing in the macro variable of the machine device for the following process in the communication scheme (language) and the macro variable name on the basis of the measurement values obtained by averaging the searched values. Therefore, it is possible not only to reflect

the dimension results of the processing target after the processing in the previous process to the following process between the machine devices in the previous and following processes having different communication schemes (languages) and macro variable names but also to calculate a correction value through calculation processing on the measurement values on the NC program for the machine device in the following process by using the measurement values obtained by leveling processing errors in consideration of the measurement values in the previous process in the past in addition to the measurement values in the previous process performed immediately before as the dimension of the processing target that is actually input to the following process, and to perform processing with correction of the processing position by the amount corresponding to the correction value on the NC program.

[0020] Specifically, in a second dimensional correction example (dimensional correction 2),

the centralized processing control system is configured such that

once an operation process of the different machine device operating after the operation process of the one machine device ends, the centralized processing control system further stores the different machine device, the operation process, and measurement positions and measurement values of a processing target and the

processing target after processing in an associated manner as following process measurement data, and

when the different machine device that is to be caused to operate after the operation process of the one machine device is caused to operate,

the centralized processing control system retrieves measurement values in a previous process from the previous process measurement data, executes statistical processing on the most recent following process measurement data, and calculates an error due to an influence of a current different machine device as a correction value, and

the centralized processing control system determines a communication scheme and a macro variable name related to dimensional correction in accordance with the different machine device from the communication scheme and variable correspondence table by using the dimensional correction as the request for writing for the different machine device on the basis of the measurement values and the correction value, and transmits an instruction to write a numerical value in a macro variable determined by the communication scheme determined for a CNC device of the different machine device.

[0021] In the second dimensional correction example (dimensional correction 2), composite calculation which is difficult to be performed by an ordinary NC program of

a machine tool is executed by the present centralized processing control system having a unified communication scheme (language) and macro variable name, the result is fed back to calculate a correction value in consideration of influences of tool wear, thermal distortion, and the like of the machine device (different machine device) in the current following processing, and the correction value is written along with the measurement values in the previous process in the communication scheme (language) and the macro variable name of the machine device in the following process, thereby performing the processing with correction of the processing position by the amount of the correction value on the NC program of the machine device for the following process as the dimension of the processing target input to the following process. In this manner, it is possible to statistically process the measurement data after the previous process in the past by the present centralized processing control system in advance and to reflect it to the machine device for the following process even for the complicated NC program of the machine device that is difficult to be calculated.

Advantageous Effect of Invention

[0022] According to the centralized processing control system of the present invention, it is possible to remotely manage NC programs of a plurality of machine devices, which are CNC-controlled by the NC programs of

various different communication schemes (languages) and macro variables, in a centralized manner while saving past data in a centralized manner with a unified communication scheme (language) and macro variable name. In addition, the present centralized processing control system also has a complementary meaning of a CNC control device of each machine device in the related art that complicated calculation processing, which is difficult for the NC program of each machine device in the related art, is externally executed in advance and the result thereof is reflected to the NC program of each machine device.

Brief Description of Drawings

[0023]

[Figure 1] Figure 1 illustrates a conceptual diagram example of reading NC programs of CNC control devices for a plurality of machine devices using a centralized management system of the present invention and monitoring operation statuses of the machine devices.

[Figure 2] Figure 2 illustrates a conceptual diagram example of managing the operation statuses of the machine devices by providing requests for writing to the NC programs of the CNC control devices to cause the plurality of machine devices to modify their operations using the centralized management system of the present invention.

[Figure 3] Figure 3 illustrates an example of a communication scheme and variable correspondence table listing correspondences of communication schemes (languages) and macro variable names of the machine devices and the CNC control devices and communication schemes (languages) and macro variable names corresponding to the centralized management system of the present invention.

[Figure 4] Figure 4 is a photograph showing an example of an actual processing line in a centralized processing control system that executes dimensional correction 1.

[Figure 5] Figure 5 illustrates a flow to execute the dimensional correction 1.

[Figure 6] Figure 6 illustrates the flow to execute the dimensional correction 1.

[Figure 7] Figure 7 illustrates a part of a flow to execute dimensional correction 2.

[Figure 8] Figure 8 illustrates a part of the flow to execute the dimensional correction 2.

[Figure 9] Figure 9 illustrates a main program for a process to execute the dimensional correction 1.

[Figure 10] Figure 10 illustrates a process 1 program in process 1 processing in the main program in Figure 9.

[Figure 11] Figure 11 illustrates a sub-program for recording a workpiece offset in the process 1 processing and process 2 processing in the main program in Figure 9 in an external device.

[Figure 12] Figure 12 illustrates a sub-program for recording a tool offset in the process 1 program in Figure 10 in the external device.

[Figure 13] Figure 13 lists macro variable names and content of the variables illustrated in Figures 9 to 12.

[Figure 14] Figure 14 illustrates a main program for a process to execute the dimensional correction 2.

Description of Embodiments

[0024] Figure 1 illustrates a conceptual diagram example of reading NC programs of CNC control devices for a plurality of machine devices using a centralized management system of the present invention and monitoring operation statuses of the machine devices. Also, Figure 2 illustrates a conceptual diagram example of managing the operation statuses of the machine devices by providing requests for writing to the NC programs of the CNC control devices to cause the plurality of machine devices to modify their operations using the centralized management system of the present invention. Moreover, Figure 3 illustrates an example of a communication scheme and variable correspondence table listing correspondences of communication schemes (languages) and macro variable names of the machine devices and the CNC control devices and communication schemes (languages) and macro variable names corresponding to the centralized management system of the present invention.

[0025] As illustrated in Figure 1, the present centralized processing control system monitors operation statuses of machine tools 14 (14a, 14b, and the like) and industrial robots 16 (16a, 16b, and the like) that constitute a processing line for processing a processing target by a centralized processing control means 10 capable of bidirectionally communicating with an external device 12 and of other industrial CNC machine devices 18 (18a, 18b, and the like)

[0026] The centralized processing control means 10 is software operating on a personal computer (PC), communicates with CNC control devices for machine tools 14, robot control devices (CNC control devices (robot controllers)) for industrial robots 16, and CNC control devices for other industrial CNC machine devices, acquires, calculates, and depicts internal variable information (macro variable names and numerical values thereof), and provides feedback programmed in advance to the CNC control devices in accordance with the calculation results. Also, the external device 12 is assumed to be a device having a communication function and a calculation function, such as a server, a PC, a programmable logic controller (PLC: a control device used to control devices, facilities, and the like), or a microcomputer. Moreover, the centralized processing control means 10 is software that executes monitoring (reading) of operation statuses of the machine tools 14

and the like and operation control (writing), which will be described later, in the centralized processing control system of the present invention, and the centralized processing control means 10 may be installed in a PC such that it operates through bidirectional communication inside the PC in a case where the external device 12 is a PC, or two PCs, namely a PC as the external device 12 and a PC on which the centralized processing control means 10 is installed may perform bidirectional communication.

[0027] Also, the machine tools 14 are so-called NC machine tools that perform cutting, grinding, shearing, forging, rolling, and the like on a processing target (workpiece) and have CNC control devices having an external communication function to cause the machine tools to operate in response to instructions by NC programs. The industrial robots 16 are adapted to perform various processing processes such as transporting, processing, assembling, washing, and deburring operations by robot bodies including movable shafts (joints) and arms driven by actuators and have CNC control devices that are called "control boxes", have an external communication function, and are similar to those described above. Moreover, other industrial CNC machine devices 18 are, for example, numerical value control and measurement devices 18a such as three-dimensional measuring instruments and numerical value control conveyors 18b such as loaders, and operations thereof are

controlled by CNC control devices that have an external communication function, similarly to the machine tools 14 and the industrial robots 16.

[0028] <<Regarding reading of information about operations and the like of each machine device>>

Next, in regard to the centralized management system of the present invention, a flow of reading NC programs of the CNC control devices for the plurality of machine tools 14a to 14c and the like, industrial robots 16a, 16b, and the like, and other industrial CNC machine devices 18a and 18b and monitoring operation statuses of the machine devices 14 to 18 by using the centralized processing control means 10 and the external device 12 will be described with reference to Figure 1.

[0029] In a case where it is desired to monitor a current operation status of any of the machine devices 14, 16, and 18, the centralized processing control means 10 provides a request for reading information about the target one of the machine devices 14, 16, and 18 to the external device 12 first. In a case where information about a CNC control device for the machine tool 14a (machine 0001; manufactured by Company A) is to be read, for example, a request for reading with content of "read information @@ from the machine 0001" from the centralized processing control means 10 of the present invention is provided by a communication scheme "function (language) σ" of the centralized processing control means

10, and the communication scheme and variable correspondence table as shown in Figure 3 stored in the external device 12 is called (STEP 1: see the reference sign 20).

[0030] Once the communication scheme and variable correspondence table is called in STEP 1, a communication scheme and a macro variable name corresponding to the request for reading and the corresponding one of the machine devices 14, 16, and 18 are determined from the communication scheme and variable correspondence table (STEP 2). For example, a case where the information about the CNC control device for the machine tool 14a (machine 0001; manufactured by Company A) described above is read will be exemplified in the communication scheme and variable correspondence table in Figure 3. In a case where a macro name corresponding to "information @@" in the communication language "σ" of the centralized processing control means 10 (machine number "0": control device, "the present software") is "A1", it is determined that a communication language "a" and a macro variable name "#1" correspond to the machine tool 14a (the machine number "1": control device "CNC from Company A") (above STEP 2). It will be understood that in this manner, the request for writing in the communication scheme (language) and the macro variable name of the centralized processing control means 10 of the present invention has been translated into the communication scheme (language)

and the macro variable name of the machine tool 14a from the communication scheme and variable correspondence table in Figure 3.

[0031] Also, once the communication scheme (language) and the macro variable name for the target one of the machine devices 14, 16, and 18 are determined and translated in response to the request for reading in STEP 2, an inquiry for operation information about the machine devices 14, 16, and 18 is made with a request for writing in a language translated in accordance with the machine devices 14, 16, and 18 (STEP 3). In the case of a request for reading of "read information @@ from the machine 0001" described above, for example, the communication language "a" and the macro variable name "#1" in accordance with the machine tool 14a are determined and translated in STEP 2, an instruction to determine the communication language "a" and the macro variable name "#1" of the machine tool 14a and read the machine tool 14a is then transmitted from the present centralized processing control means 10 (see the reference sign 22), and the CNC control device for the machine tool 14a that has received the instruction reads the numerical value of the macro variable name "#1" during the operation and transmits it from the present centralized processing control means 10 (STEP 4). In this manner, the present centralized processing control means 10 acquires the operation information of the

machine tool 14a in the communication scheme (language) and the macro variable name of the machine tool 14a.

[0032] Furthermore, once the operation information of the machine tool 14a is acquired in the communication scheme (language) and the macro variable name of the machine tool 14a in STEP 4, the present centralized processing control means 10 calls the communication scheme and variable correspondence table saved in the external device 12 again, updates the communication scheme and variable correspondence table, determines the communication scheme (language) and the macro variable name of the present centralized processing control means 10 corresponding to the communication scheme (language) and the macro variable name of the machine tool 14a from the communication scheme and variable correspondence table in the manner opposite to STEP 2, and transmits and outputs the communication scheme (language) and the macro variable name (the numerical value thereof) to the external device 12 (see the reference sign 21). In a case where the operation information from the machine tool 14a (machine number "1": control device "CNC from Company A") includes a communication language "a", a macro variable name "#1", and a numerical value ddd, for example, the macro variable name of the communication language "σ" of the present centralized processing control means 10 is updated to the numerical value ddd, and an output of "the value of the information @@ from

the machine 0001 is ddd" is provided to the external device 12 such as a PC in the communication language "σ" (above STEP 5). It is possible to ascertain that the present centralized processing control means 10 can thus monitor the operation information with the unified communication scheme (language) and the macro variable name (and the numerical value thereof) even for the machine devices 14, 16, and 18 having different communication schemes (languages) and macro variable names.

[0033] <<Regarding writing of information about operations and the like in each machine device>>

Next, in regard to the centralized management system of the present invention, a flow of performing control such as a modification on operation statuses of the machine devices 14 to 18 by wiring information in the NC programs of the CNC control devices of the plurality of machine devices (the machine tools 14, the industrial robots 16, and other industrial CNC machine devices 18) similar to those in Figure 1 by using the centralized processing control means 10 and the external device 12 will be described with reference to Figure 2.

[0034] In a case where it is desired to perform management such as a modification of a current operation status of any of the machine devices 14, 16, and 18, the centralized processing control means 10 provides a request for writing information in the target one of the

machine devices 14, 16, and 18 to the external device 12. In a case where information such as a modification is to be written in a robot control device for the industrial robot 16a (industrial robot 001; manufactured by Company A), for example, a request for writing with content of "write the numerical value dd in information @@ of the industrial robot 001" from the centralized processing control means 10 of the present invention is provided in the communication scheme "function (language) σ " of the centralized processing control means 10, and the communication scheme and variable correspondence table shown in Figure 3 as described above stored in the external device 12 is called (STEP A: see the reference sign 30).

[0035] Once the communication scheme and variable correspondence table is called in STEP A, a communication scheme and a macro variable name corresponding to the machine devices 14, 16, and 18 of the request for writing are determined from the communication scheme and variable correspondence table (STEP B). For example, a case where information such as a modification is to be written in the robot control device for the industrial robot 16a (industrial robot 001; manufactured by Company A) described above will be exemplified in the communication scheme and variable correspondence table in Figure 3. In a case where the macro variable name corresponding to the "information @@" of the communication language " σ " of the

centralized processing control means 10 (machine number "0": control device "present software") is "A2", it is determined that a communication language "d" and a macro variable name "REGI 2" correspond to the industrial robot 16a (machine number "1001": control device "ROBOT from Company A") (above STEP B). It is possible to ascertain that the request for writing in the communication scheme (language) and the macro variable name of the centralized processing control means 10 of the present invention has been translated into the communication scheme (language) and the macro variable name of the industrial robot 16a from the communication scheme and variable correspondence table in Figure 3.

[0036] Also, once the communication scheme (language) and the macro variable name for the target one of the machine devices 14, 16, and 18 are determined and translated in response to the request for writing in STEP B, an inquiry for operation information about the machine devices 14, 16, and 18 is made with the request for writing in a language in accordance with the machine devices 14, 16, and 18 (STEP C). In the case of the request for writing of "write the numerical value dd in information @@ of the industrial robot 001" described above, for example, the communication language "d" and the macro variable name "REGI 2" in accordance with the industrial robot 16a are determined and translated in STEP B, an instruction to write the communication language "d" and the macro

variable name "REGI 2" of the industrial robot 16a in the industrial robot 16a is then transmitted from the present centralized processing control means 10 (see the reference sign 32), and the present centralized processing control means 10 performs transmission by setting the numerical value of the macro variable name "REGI 2" in the robot control device for the industrial robot 16a that has received the instruction to dd (STEP D). In this manner, the present centralized processing control means 10 can provides an instruction by using the request for writing input in the communication scheme (language) and the macro variable name of the centralized processing control means 10 set as unified ones as a request for writing to perform modification or the like of the NC program in the communication scheme (language) and the macro variable name unique to the industrial robot 16a.

[0037] Furthermore, once the robot control device for the industrial robot 16a receives the writing instruction made in the communication scheme (language) and the macro variable name in STEP D, whether control to perform modification or the like of the numerical value of the corresponding macro variable of the NC program for the industrial robot 16a to be permitted or refused is determined, and the NC program is rewritten and a response signal of permission is transmitted at the same time in a case of permission, or a response signal of

refusal is transmitted in a case of refusal. The present centralized processing control means 10 that has received the response signal of permission or refusal calls the communication scheme and variable correspondence table (Figure 3) saved in the external device 12 again, saves and updates the numerical value "dd" and "permission/refusal" in the past history of the macro variable name "REGI 2" of the machine number "1001", transmits the response of "permission/refusal" to the external device 12 such as a PC, and outputs a response of "permission/refusal" in the communication language "σ" (see the reference sign 31: STEP E). It is possible to ascertain that the present centralized processing control means 10 can thus control operations with the unified communication scheme (language) and macro variable name (and a numerical value thereof) even for the machine devices 14, 16, and 18 having different communication schemes (languages) and macro variable names.

[0038] <<Example 1 (dimensional correction 1)>>

Next, correction of processing dimensions (hereinafter, also referred to as "dimensional correction 1") of the machine devices 14, 16, and 18 executed by software (hereinafter, also referred to as "present software 10") as the centralized processing control means 10 in the centralized processing control system of the present invention will be described as an example.

Figure 4 is a photograph showing an example of an actual

processing line in a centralized processing control system that executes the dimensional correction 1. Figures 5 and 6 illustrate a flow to execute the dimensional correction 1.

[0039] As shown in the example of the processing line in Figure 4, once processing of a workpiece (processing target) with the machine tool 14a ends first, then the industrial robot 16a grips the workpiece. At this time, the present software 10 provides a request to read the workpiece (processing target) of the machine tool 14a after processing in the previous process along with the number thereof (workpiece No.) to the CNC control device of the machine tool 14a, acquires information of the workpiece No., and transmits the workpiece No. to the industrial robot 16a as illustrated in the flowchart in Figure 5 (STEP 111 and STEP 113).

[0040] Specifically, once the processing with the machine tool 14a ends first, a request for reading with content of "read information (numerical value) of the workpiece No. from the machine tool 00011" is made in the communication scheme "function (language) σ " and the macro variable name "A1, A2, ... and the like" from the present software 10 as described above with reference to Figure 1, the communication scheme and variable correspondence table (see Figure 3) stored in the external device 12 is called, the communication language "a" and the macro variable name "#1, #2, ... and the

like" of the machine tool 14a (machine number 1: control device "CNC from Company A") are determined by the present software 10, and the CNC control device for the machine tool 14a that has received the instruction in the communication language and the macro variable name reads a response numerical value of the workpiece No. of the macro variable from the NC program and acquires the present software 10 (STEP 111).

[0041] Next, the present software 10 that has acquired the workpiece No. of the machine tool 14a after the processing in the previous process ends provides a request for writing with content of "write the workpiece No. (numerical value) in workpiece information of the industrial robot 0001" in the communication scheme "function (language) σ " and the macro variable name "A1, A2, ... and the like" of the present software 10 to the industrial robot 16a as described above with reference to Figure 2, calls the communication scheme and variable correspondence table from the external device 12 similarly to STEP 111, and determines the communication language "d" and the macro variable name "REGI 1, REGI 2, ... and the like" of the industrial robot 16a (machine number 1001: control device "ROBOT from Company A"), and the robot control device for the industrial robot 16a that has received the instruction in the communication language and with the macro variable name writes the

numerical value of the workpiece No. in the corresponding macro variable of the NC program (STEP 113).

[0042] Next, as shown in the example of the processing line of Figure 4, once the industrial robot 16a acquires the workpiece, the dimension of the workpiece after the processing in the previous process with the machine tool 14a ends is measured at a plurality of points on the workpiece by using a measuring instrument 19 that is different from the industrial robot 16a. At this time, the present software 10 provides a request for reading the workpiece No. and the measurement positions when the workpiece is measured at the plurality of points by the industrial robot 16a and the measuring instrument 19 to the robot control device for the industrial robot 16a, and saves (stores) the information regarding the workpiece No. and the measurement positions obtained in response to the request for reading and measurement value information obtained by the measuring instrument 19 in an associated manner (STEP 121 to STEP 125).

[0043] Specifically, the industrial robot 16a causes the workpiece obtained from the machine tool 14a in the previous process to move, sets the workpiece such that the measuring instrument 19 can perform measurement at the plurality of positions (measurement points) on the workpiece, and measures the dimension with the measuring instrument 19 (STEP 121). The measurement values obtained by the measuring instrument 19 are separately

transmitted to and saved (stored) in the external device 12. At this time, the present software 10 provides a request for reading with content of "read information (numerical value) about the workpiece No. and robot coordinates from the industrial robot 1001" in the communication scheme "function (language) σ " and the macro variable name "A1, A2, ... and the like" of the present software 10 similarly to STEP 111 as described above with reference to Figure 2 at each measurement position, and determines the communication language "d" and the macro variable name "REGI 1, REGI 2, ... and the like") of the industrial robot 16a (machine number 1001: control device "ROBOT from Company A") from the communication scheme and variable correspondence table, and the robot control device for the industrial robot 16a that has received the instruction in the communication language and the macro variable name reads response numerical values of the robot coordinates of the macro variable from the NC program, and the present software 10 acquires them along with the workpiece No., translates them into the communication scheme (language) and the macro variable name of the present software 10, inputs them to the communication scheme and variable correspondence table, and saves them in the external device 12 as described above in Figure 1 (STEP 123). [0044] Next, the workpiece No. and the robot coordinates at each measurement position saved (stored) in the

external device 12 are saved (stored) in the external device 12 in association with the measurement values obtained by the measuring instrument 19 at each measurement position saved (stored) in the external device 12 described above (STEP 125).

[0045] Moreover, the workpiece after being subjected to the dimension measurement by the industrial robot 16a and the measuring instrument 19 is passed from the industrial robot 16a to the industrial robot 16b as shown in the example of the processing line in Figure 4, is transported by the industrial robot 16b, and is input and attached to the machine tool 14b, and the workpiece after the processing by the machine tool 14a is further processed by the machine tool 14b. At this time, the present software 10 provides a request for writing the workpiece No. to the industrial robot 16a and the machine tool 14b, provides a request for writing the workpiece No. and an average value of the past history of measurement values for the workpiece as a workpiece dimension to a variable region of the machine tool 14b, and executes the NC program of the machine tool 14b (STEP 131 to STEP 153).

[0046] Specifically, for the industrial robot 16b to which the workpiece is to be passed from the industrial robot 16a, a request for writing with content of "write the workpiece No. (numerical value) in workpiece information of the industrial robot 1002" of the present software 10 is translated from the communication scheme

"function (language) σ" and the macro variable name "A1, A2, ... and the like" of the present software 10 into the communication language "e" and the macro variable name "B1, B2, ... and the like" of the industrial robot 16b (machine number 1002: control device "ROBOT from Company E") using the communication scheme and variable correspondence table similarly to STEP 111 and STEP 115, and the robot control device for the industrial robot 16b that has received the instruction in the communication language and the macro variable name writes the numerical value of the workpiece No. in the macro variable of the NC program (STEP 131). Thereafter, the "function (language) σ" and the macro variable name "A1, A2, ... and the like" of the present software 10 are translated into the communication language "b" and the macro variable name "#1, #2, ... and the like" of the machine tool 14b (machine number 2: control device "CNC from Company B") similarly to STEP 131, and the CNC control device for the machine tool 14b that has received the instruction in the communication language and the macro variable name writes the numerical value of the workpiece No. in the macro variable of the NC program (STEP 141). [0047] Next, the present software causes the external device 12 to search for the measurement values of the workpiece No. after the previous process saved (recorded) in the external device 12 in STEP 125 and in the past and causes the external device 12 to calculate an average

value of the searched measurement values (STEP 151). The present software 10 provides a request for writing the calculated average value of the workpiece No. to the machine tool 14b, transmits it as an initial dimension of the attached workpiece to the variable region of the machine tool 14b, and causes the NC program to be executed (STEP 153: see the NC program in Figures 9 to 13). Specifically, the present software 10 provides a request for writing with content of "write a calculated average value zz in a variable region for the workpiece initial dimension of the machine tool 14b" in the communication scheme "function (language) σ " and the macro variable name "A1, A2, ... and the like" of the present software 10, the communication scheme and variable correspondence table is called from the external device 12 similarly to STEP 113, and the CNC control device for the machine tool 14b writes the calculated numerical value zz in the variable region of the communication language "b" and the macro variable name "#1, #2, ... and the like" indicating the initial dimension of the machine tool 14b (machine number 2: control device "CNC from Company B") (STEP 153). In this manner, the machine tool 14b can cause the processing at the machine tool 14b to be executed on the workpiece with the dimension after the previous processing as an initial state.

[0048] Then, after above STEP 153 by the present software 10, the machine tool 14b that has received the dimension value (average value) of the workpiece No. performs calculation processing in the NC program by regarding the dimension value as that of the input or attached workpiece to calculate a correction value, and checks whether or not the correction value falls within a normal range. In a case where the checked correction value is outside the normal range and is determined to be abnormal in the NC program of the machine tool 14, an error signal is transmitted, and the present software 10 that has received the error signal outputs the error signal to the external device 12. On the other hand, in a case where the checked correction value falls within the normal range and is determined to be normal, the machine tool 14 executes the processing by reflecting the processing position by the amount of the correction value to the NC program. Therefore, even if there is a dimensional error in the previous processing, it is possible to constantly perform working with an accurate dimension value in consideration of the dimensional error.

[0049] As such an NC program for the machine tool 14b, Figures 9 to 13 illustrate an example for reference. Figure 9 illustrates a main program of a process in which the machine tool 14b executes the dimensional correction 1, Figure 10 illustrates a process 1 program for process 1 processing (N111) in the main program of Figure 9,

Figure 11 illustrates a sub-program 1 for recording, in the external device 12 (external PC), a workpiece offset in the process 1 processing (N111) and process 2 processing (N02) in the main program of Figure 9, and Figure 12 illustrates a sub-program 2 for recording, in the external device 12 (external PC), a tool offset in the process 1 program of Figure 10. Also, Figure 13 illustrates a list of macro variable names and content of the variables thereof shown in Figures 9 to 12, and in particular, macro variables #501 to #516 show macro variables to be used in instructions for reading and writing from the present software. Note that Figures 9 to 13 provide brief description of each of the NC programs and the macro variables within parentheses.

[0050] Returning again to the flow executed by the present software 10 illustrated in Figures 5 and 6, once the processing by the machine tool 14b ends, the workpiece is detached from the machine tool 14b and is received by the industrial robot 16b as shown in the processing line example of Figure 4. At this time, the industrial robot 16 acquires the workpiece of the machine tool 14b after the processing in the subsequent process ends along with the workpiece No., and the present software 10 transmits the workpiece No. to the industrial robot 16a (STEP 181).

[0051] Specifically, once the processing by the machine tool 14b ends, the present software 10 provides a request

for reading with the content of "read information (numerical value) of the workpiece No. from the machine tool 14b" (omitted because this is similar to STEP 111), the present software 10 that has acquired the workpiece No. of the machine tool 14b after the processing ends provides a request for writing with content of "write the workpiece No. (numerical value) in the workpiece information of the industrial robot 002" to the industrial robot 16b in the communication scheme "function (language) σ " and the macro variable name "A1, A2, ... and the like" of the present software 10, calls the communication scheme and variable correspondence table, and determines the communication language "e" and the macro variable name "REGI 1, REGI 2, ... and the like" of the industrial robot 16b (machine number 1002: control device "ROBOT from Company E"), and the robot control device for the industrial robot 16b that has received the instruction in the communication language and the macro variable name writes the numerical value of the workpiece No. in the macro variable of the NC program (STEP 181).

[0052] <<Example 2 (dimensional correction 2)>>

Next, dimensional correction 2 as a modification of the dimensional correction 1 for the machine devices 14, 16, and 18 to be executed by the present software 10 according to the centralized processing control system of the present invention described above will be described

as an example. The dimensional correction 2 is executed in the processing line illustrated in Figure 4 similarly to the dimensional correction 1, the most part of the flow executed by the present software 10 is similar to those in Figures 5 and 6, and a flow different from the dimensional correction 1 (Figures 5 and 6) in the flow executed by the present software 10 will thus be described here as an example in the flowchart of Figures 7 and 8.

[0053] In the processing line example of Figure 4, once the machine tool 14a ends the processing of the workpiece as a previous process, the processed workpiece is then acquired by the industrial robot 16a, and the industrial robot 16a and the measuring instrument 19 measure the workpiece and then pass it to the industrial robot 16b as described above. Thereafter, the industrial robot 16b inputs or attaches the workpiece to the machine tool 14b and causes the machine tool 14b to execute processing thereon. At this time, as described above in the flowchart of Figure 5, the present software 10 provides a request for reading the workpiece No. of the machine tool 14a after the processing in the previous process to the CNC control device for the machine tool 14a and transmits the workpiece No. to the industrial robot 16a (STEP 111 and STEP 113), then provides a request for reading the workpiece No. and each measurement position when the industrial robot 16a and the measuring instrument 19 have

measured the workpiece at a plurality of points to the robot control device for the industrial robot 16a and saves (stores) the information regarding the workpiece No. and the measurement position information in association with the measurement value information of the measuring instrument 19 (STEP 121 to STEP 125), and further provides a request for writing the workpiece No. to the industrial robot 16a and the machine tool 14b (STEP 131 to STEP 141). The flow executed by the present software 10 in the dimensional correction 2 is similar to that in the aforementioned case of the dimensional correction 1 up to this point.

[0054] In the example of the dimensional correction 1, the present software 10 then causes the external device 12 to search for the measurement values after the previous process from the past history on the basis of the workpiece No., calculates an "average value" thereof, provides a request for writing the calculated average value as a workpiece dimension in the variable region of the machine tool 14b for the following process, and executes the NC program of the machine tool 14b (STEP 131 to STEP 153). In the dimensional correction 1, the "correction value" is calculated by performing calculation processing in the NC program using the dimension value (average value) that the machine tool 14b has received as that of the input or attached workpiece,

and abnormality or normality is determined by the "correction value".

[0055] On the other hand, in the case of the dimensional correction 2, a calculation flow of the "correction value" of the workpiece to be input to the machine tool 14b in STEP 131 to STEP 153 in Figures 5 and 6 above is different. In the dimensional correction 2, the present software provides a request for writing the workpiece No. to the industrial robot 16a and the machine tool 14b in STEP 131 to STEP 141, and the present software 10 then causes the external device 12 to search for the measurement values after the previous process from the past history on the basis of the workpiece No. (STEP 251a) and performs composite calculation of the "correction value" of the workpiece on the basis of the measurement value (*) after the processing by the machine tool 14b in the latest following process (STEP 251b). Specifically, a plurality of pieces of latest data is extracted from the saved data in which the measurement positions of the workpiece at the plurality of points in the following process by the machine tool 14b and the measurement value (dimension value) at each of the positions are associated through STEP 291 to STEP 295, which will be described later, and composite calculation in consideration of a processing error amount due to various factors such as tool wear and thermal distortion of the machine tool 14b is executed on the data from

statistics, thereby calculating the "correction value" (STEP 251b). In this manner, the dimension data after the following process in the past is fed back, and influences on the processing error at the machine tool 14b that is to perform the following process are compositely calculated from statistical data to thereby calculate the "correction value" of the following process to be performed next. Therefore, although only the dimensional measurement error of the workpiece after the previous process is reflected to the following process in the dimensional correction 1 in which the past history of the dimension measurement values after the processing by the machine tool 14a, which is the previous process, is simply averaged to obtain the "correction value" of the following process, the dimensional correction 2 is advanced in that influences of tool wear, thermal distortion, and the like in the following process of the input workpiece are statistically considered from the past results when the workpiece with the dimension after the previous process is input to the following processing and the processing is then executed thereon to thereby calculate the "correction value". It is possible to execute the statistical processing using a past database, which is difficult to be executed by the CNC control device, by the present software 10 and to constantly process the workpiece with an accurate dimension value in consideration of a dimensional error even if a small

dimensional error occurs in the previous process by the machine tool 14a.

[0056] Specifically, the present software 10 causes the external device 12 to perform the composite calculation of the "correction value" of the workpiece in STEP 251b and then saves (stores) the workpiece No. and the measurement value at each measurement position saved (stored) in the external device 12 STEP 125 in association with the "correction value" in the external device 12 (STEP 251c). Then, the present software 10 determines whether or not the "correction value" falls within a preset normal range (STEP 251d), and in a case where the "correction value" is outside the normal range and is determined to be abnormal, outputs an error signal to the external device 12, and the output error signal is saved (stored) in association with the aforementioned saved (stored) workpiece No. and the measurement value at each measurement position (STEP 251d to STEP 251e).

[0057] In a case where the present software 10 determines that the "correction value" falls within the normal range and is normal, the present software 10 causes the external device 12 to search for the measurement value of the workpiece No. after the previous process and the "correction value" therefor saved (stored) therein or cause the external device 12 to calculate an average value of searched "correction values" (STEP 251f), provides a request for writing the "correction value" to

the CNC control device for the machine tool 14b, transmits as the initial dimension of the workpiece to the variable region of the machine tool 14b, and causes the machine tool 14b to offset-input the "correction value" on the NC program and execute the NC program (STEP 253: see the NC program in Figure 14). STEP 251a to STEP 253 correspond to one flow of the present software 10 in the dimensional correction 2 that is different from STEP 151 to STEP 153 in the dimensional correction 1.

[0058] As such an NC program for the machine tool 14b, Figure 14 illustrates an example for reference. Figure 14 illustrates a main program of a process for executing the dimensional correction 2 in the machine tool 14b, and for the process 1 program and the sub-programs, which are the same as those in the dimensional correction 1, Figures 10 to 13 will be referred to. In addition, Figure 14 also provides brief description in parentheses for the NC programs and the macro variables similarly to Figures 9 to 13. It is also possible to ascertain from the main program of the NC program for the machine tool 14b indicated as N01 in Figure 14 that in the dimensional correction 2, the present software 10 causes the external device 12 to calculate the "correction value" calculated through composite calculation in advance and the "correction value" is just written in the offset in the NC program for the machine tool 14b.

[0059] Returning again to the flow executed by the present software 10, once the processing by the machine tool 14b ends, the workpiece is detached from the machine tool 14b and is received by the industrial robot 16b as shown in the processing line example of Figure 4 similarly to the dimensional correction 1, and the present software 10 acquires the industrial robot 16b along with the workpiece No. after the processing by the machine tool 14b in the following process and transmits the workpiece No. to the industrial robot 16b similarly to STEP 181 in Figure 6.

[0060] Here, in the dimensional correction 2, the present software 10 measures the workpiece after the processing in the following process at a plurality of points by the industrial robot 16b and saves (stores) the workpiece No., the measurement positions (robot coordinate information) of the workpiece, and each measurement value of the dimension in an associated manner in the external device 12 such that feedback can be given in the next following process by the machine tool 14b in the processing line of Figure 4 and the "correction value" of the workpiece dimension in the following process by the machine tool 14b can be compositely calculated in STEP 251 described above.

[0061] Specifically, according to the present software 10, the industrial robot 16 with the workpiece No. written therein causes the workpiece obtained from the machine

tool 14b in the following process to move and sets the workpiece such that the measuring instrument (not illustrated (hereinafter, also referred to as a "measuring instrument (another)")) can measure the workpiece at a plurality of positions (measurement points), and the measuring instrument (another) measures the dimension (STEP 291). The measurement values obtained by the measuring instrument (another) are transmitted to and saved (stored) in the external device 12. At this time, the present software 10 provides a request for reading with content of "read the workpiece No. and information (numerical values) regarding robot coordinates from the industrial robot 16b" in the communication scheme "function (language) σ " and the macro variable name "A1, A2, ... and the like" of the present software 10 similarly to STEP 121 at each measurement position and determines the communication language "e" and the macro variable name "B1, B2, ... and the like" of the industrial robot 16b (machine number 1002: control device "ROBOT from Company E") from the communication scheme and variable correspondence table, the robot control device for the industrial robot 16b that has received the instruction in the communication language and the macro variable name reads response numerical values of the robot coordinates of the macro variable from the NC program, and the present software 10 acquires them along with the workpiece No., translates

them into the communication scheme (language) and the macro variable name of the present software 10, inputs them to the communication scheme and variable correspondence table, and saves them in the external device 12 (STEP 293).

[0062] Thereafter, the workpiece No. and the robot coordinates at each measurement position saved (stored) in the external device 12 are saved (stored) in the external device 12 in association with the aforementioned measurement values obtained by the measuring instrument 19 at each measurement positions and saved (stored) in the external device 12 (STEP 125). The saved (stored) workpiece No. and measurement values at each measurement positions are fed back in STEP 251b described above in the next and following processing line and is used for composite calculation of the "correction value" of the workpiece to be input to the machine tool 14b in the following process.

[0063] Although the embodiment as an example of the present centralized processing control system has been described hitherto, the present invention is not limited to the configuration, and those skilled in the art will easily understand from the description and the idea of the claims that there may be other embodiments.

Reference Signs List

[0064] 10 Centralized processing control means

12 External device

14, 14a, 14b Machine tool

16, 16a, 16b Industrial robot

18, 18a, 18b Another industrial CNC machine device

19 Measuring instrument

Claims

[Claim 1]

A centralized processing control system that externally monitors and manages CNC control devices, with which machine devices operating by various NC programs are able to communicate, in a unified manner regardless of communication schemes and variables, the centralized processing control system being configured such that

a communication scheme and variable correspondence table indicating the communication schemes and macro variable names of the NC programs corresponding to the machine devices and the CNC control devices and a unified communication scheme and macro variable name corresponding to the centralized processing control system is stored and updated, and

once a request for reading operation information of an arbitrary machine device is provided, the centralized processing control system determines a communication scheme and a macro variable name in accordance with content of the request for reading and the machine device from the communication scheme and variable correspondence table, transmits an instruction to call a macro variable determined by using the determined communication scheme to a CNC control device of the machine device of the request for reading, and outputs a response numerical

value of the macro variable called in response to reception of the instruction as a response numerical value of the unified communication scheme and macro variable name from the communication scheme and variable correspondence table.

[Claim 2]

The centralized processing control system according to claim 1,

wherein the centralized processing control system is configured such that

once a request for writing operation information of an arbitrary machine device is provided, the centralized processing control system determines a communication scheme and a macro variable name in accordance with content of the request for writing and the machine device from the communication scheme and variable correspondence table, transmits an instruction to write a numerical value in a macro variable determined by a communication scheme determined for a CNC control device of the machine device of the request for writing, and in a case where the machine device of the request for writing permits or refuses the instruction and a response signal thereof is received, outputs a fact of permission or refusal as the unified communication scheme and macro variable name in the communication scheme and variable correspondence table.

[Claim 3]

The centralized processing control system according to claim 2,

wherein the centralized processing control system is configured such that

once an operation process of one machine device ends, the centralized processing control system stores the one machine device, the operation process, and measurement positions and measurement values of a processing target and the processing target after processing in an associated manner as previous process measurement data, and

when a different machine device that is to be caused to operate after the operation process of the one machine device is caused to operate,

the centralized processing control system determines a communication scheme and a macro variable name related to correction of shape information or correction of a processing condition in accordance with the different machine device from the communication scheme and variable correspondence table by using the correction of the shape information or the correction of the processing condition of a processing target as the request for writing for the different machine device defined or selected in advance on the basis of a measurement value calculated by retrieving a measurement value stored as the previous process measurement data, and transmits an instruction to write a numerical value in a macro variable determined by

a communication scheme determined for a CNC device for the different machine device.

[Claim 4]

The centralized processing control system according to claim 3,

wherein the centralized processing control system is configured such that

when a different machine device that is to be caused to operate after the operation process of the one machine device is caused to operate,

the centralized processing control system determines a communication scheme and a macro variable name related to correction of a dimension in accordance with the different machine device from the communication scheme and variable correspondence table by using the correction of the dimension of a processing target as the request for writing for the different machine device on the basis of a measurement value obtained by retrieving measurement values in a previous process from the previous process measurement data and averaging the values, and transmits an instruction to write a numerical value in a macro variable name determined by a communication scheme determined for the CNC device of the different machine device.

[Claim 5]

The centralized processing control system according to claim 3,

wherein the centralized processing control system is configured such that

once an operation process of the different machine device operating after the operation process of the one machine device ends, the centralized processing control system further stores the different machine device, the operation process, and measurement positions and measurement values of a processing target and the processing target after processing in an associated manner as following process measurement data, and

when the different machine device that is to be caused to operate after the operation process of the one machine device is caused to operate,

the centralized processing control system retrieves measurement values in a previous process from the previous process measurement data, executes statistical processing on the most recent following process measurement data, and calculates an error due to an influence of a current different machine device as a correction value, and

the centralized processing control system determines a communication scheme and a macro variable name related to correction of a dimension of the processing target in accordance with the different machine device from the communication scheme and variable correspondence table by using the correction of the dimension as the request for writing for the different machine device on the basis of

the measurement values and the correction value, and transmits an instruction to write a numerical value in a macro variable determined by a communication scheme determined for the CNC device of the different machine device.