Calculation of Arm Parameter for Surface Scanning with Axis Moment

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Abstract : In this paper proposed about the system for measuring the diffusion of the electric wave in 3D space. The end-effecter having the Pan-tilt joint in the cartesian coordinate system robot was set up and it comprised of the robotic arm of 5 degree of freedoms. In an end-effecter, the sensor measuring the diffusion of the electric wave was set up.
In the cartesian coordinate system robotic section, it was comprised of the stepping motor. And the Servo Motor was used to an end-effecter.

Keywords : robot arm, electric wave

I. INTRODUCTION

In order to measures the diffusion shape of the electric wave, therefore, the elaborate position control of a sensor the electric wave measuring sensor has to measure repetitively on the determined location is necessary. In this paper, we propose the robotic arm for measuring the electric wave diffusion shape. However, a complexity and cost of a system are enhanced if the electric wave is diffused, it tries to measure by all directions, it takes precedence to measure in the limited domain.[1][2]

II. ROBOT ARM BASIC STRUCTURE

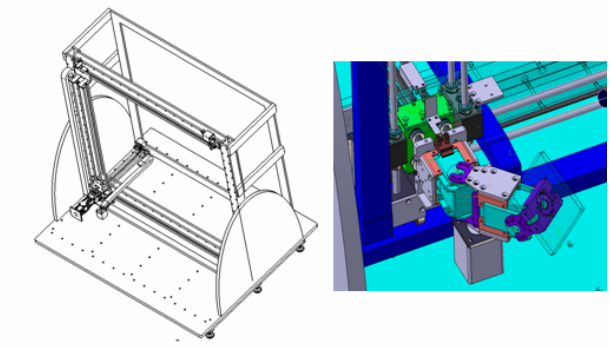

Fig.1. The configuration diagram of the robotic arm.

Fig.1 shows to be composed of the cartesian coordinate system robotic arm part and end-effector part. The cartesian coordinate system robotic arm part had 3 degree of freedoms. And it designed to operate with the stepping motor. An end-effector part has 2 degree of freedoms of Pan-tilt. And by using the Serve Motor, it is driven. Each physical spec is as follows. The robotic arm can move ± 400mm to the x-axis and ± 200mm to the y-axis and ± 400mm to the z-axis. In the Pan joint, the length to the tilt joint is 78mm. And the length to a sensor has 100m in the tilt joint.

III. CALCURATION OF ARM PARAMETER

The necessary parameter of the robotic arm for measuring the diffusion of the electric wave is the X,Y,Z value of the cartesian coordinates robot arm and The pan angle and tilt angle of the pan-tilt joint are needed.

In order to calculating each parameter, firstly the sender location is determined. The point for measuring the electric wave should be determined. A sender location assumes an origin in order to be simple. Each coordinates is moved after all calculations are completed.

First, the length to the pan-tilt joint is defined in a sensor as a l1. The length to a pan-joint is defined in a tilt-joint as a l2.

$$Pe = P + l_1 \times \frac{P}{|P|} \quad (1)$$

(1) The direction of Pe and P is the same . And the size of Pe is a l1.

$$Pan\_angle = \cos\left(\frac{P_y \times Y_{axis}}{|P_y| \times |Y_{axis}|}\right) \quad (2)$$

$$Tilt\_angle = \cos\left(\frac{P_z \times Z_{axis}}{|P_y| \times |Y_{axis}|}\right) \quad (3)$$

The Pan angle can calculate as the interval angle between the Py (projection with Y-axis P) and the Y-axis. And it can calculate the Tilt angle with the interval angle between the Pz (projection with Z-axis P) and the Z-axis.

$$Pe2 = [0\ I_2\ 0\ 1] \times Rot(Z, \alpha) \times T(Pe) \quad (4)$$

$$Rot(Z, \alpha) = \begin{bmatrix} C(\alpha) & -S(\alpha) & 0 & 0 \\ S(\alpha) & C(\alpha) & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (5)$$

$$T(P) = \begin{bmatrix} 1 & 0 & 0 & P_x \\ 0 & 1 & 0 & P_y \\ 0 & 0 & 1 & P_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (6)$$

By substituting calculated Pe and the Pan angle for (4) and using a ratation and parallel movement about the Z-axis, Pe2 is calculated.[4]

$$Pe3 = [0\ I_2\ 0\ 1] \times T(Pe2) \quad (7)$$

Pe3 can calculate through Pe2.

Finally, P, Pe, Pe2, and Pe3 are obtained after the transformation matrix defined in (6) is used in order to move as a sender given location.

IV. SIMULATION

By using Matlab, it simulated in order to verify whether it operated normally with the proposed numerical formula or not.

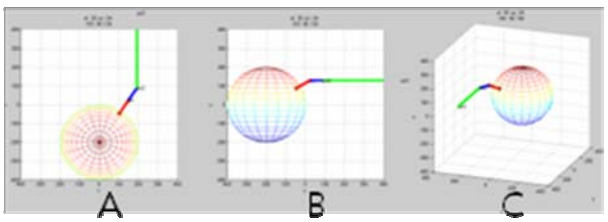

Fig.2. Matlab Simulation

The center of a globe is the transmission unit of the electric wave. An end-effect can confirm the features pointing to the center of a globe.

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VI. CONCLUSION

In this paper, 5 frees for measuring the diffusion of the electric wave were proposed about the method calculating the parameter of the joint of the robotic arm. We used a rotation and translation transform in order to calculate each joint. The task implementing HW of the robotic arm was not concluded and it simulated through a matlab but it outputted visually to calculate the parameter of the joint. It confirmed to operate normally. Presently, it remains as the subject of front to confirm whether it normallies operate by applying the parameter calculated to the implemented robotic arm or not.

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