

Adaptations of Omnidirectional Driving Gears to Practical Purposes

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I. INTRODUCTION

This video shows multiple omnidirectional driving gears to realize smaller size and weight than the ordinary X-Y stages. The examinations of different materials and sizes of the gear teeth to improve the performances of the omnidirectional driving gears are the main progress of this paper from our previous reports [1].

II. OMNIDIRECTIONAL DRIVING GEAR MADE FOR PRACTICAL PURPOSES

A. Omnidirectional Driving Gear Made with Ultra High Molecular Weight Polyethylene

We fabricated the planar omnidirectional gear made with Ultra High Molecular Weight Polyethylene with module 3 to activate X-Y stage for transportation in factories and warehouses. We selected this material because of its high feature of self-lubricating to realize smooth sliding of spur gears to activate omnidirectional driving gear [1].

B. Miniaturized Omnidirectional Driving Gear Made with Duralumin

The omnidirectional driving gear made with duralumin with module 0.5 has been used as additional degrees of freedom on an end effector of a robotic arm. We created two types of miniaturized planar omnidirectional driving gear unit, and the thinner one is shown in Fig. 1. This type of omnidirectional driving gear is used to add manipulability to limited narrow space. The specification of this omnidirectional driving gear is shown in Table 1.

TABLE I. SPECIFICATIONS OF THE MINIATURIZED OMNIDIRECTIONAL DRIVING GEAR

Teeth module	0.5
Teeth material	Duralumin
Dimensions (Length x Width x Height)	89 x 89 x 2.8 (mm)
Maximum translational speed of X and Y axis	13.1 (mm/s)
Translational force along X and Y axis	15.9 (N)
Motion range along X and Y axis	48 (mm)
Weight	39.6 (g)

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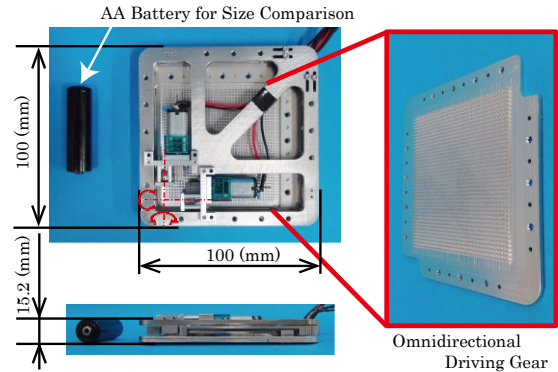


Figure 1. Miniaturized planar omnidirectional driving gear unit

III. OMNIDIRECTIONAL DRIVING GEAR FOR END EFFECTOR OF THE ROBOTIC MANIPULATOR

We attached the miniaturized planar omnidirectional driving gears to the parallel gripper of the 7 D. O. F. robotic arm as shown in Fig. 2. This commercial robotic manipulator, PA10, was made by Mitsubishi Heavy Industries, Ltd. The omnidirectional driving gears realized translational and rotational motions of grabbed objects to compensate the manipulability of the robotic arm near its singularity [2].

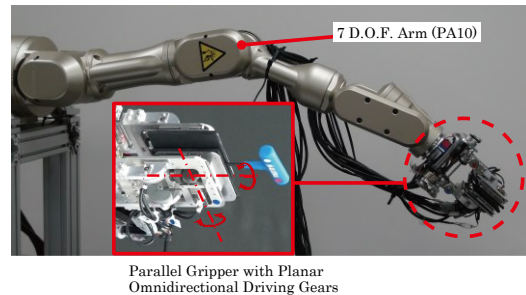


Figure 2. 7 D. O. F. robotic arm with a parallel gripper and planar omnidirectional driving gear mechanism

IV. CONCLUSIONS

The physical advantages of the omnidirectional driving gears for practical purposes were confirmed in experiments. Optimization of the design of each omnidirectional driving gear shall be continued in our future researches.

REFERENCES

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