POSSIBILITIES OF COMPACT SPHERICAL JOINT CREATING

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Abstract

In recent applications of output kinematic strings of manipulation and automation techniques, industrial robots and manipulators and other motional mechanisms is using of spherical joint not extensive. The reason is in difficult connections to the driving unit or units. The problem is generally solved by using of two or three joints with spherical joining in serial connection turned usually of 90 degrees. Using this construction design brings enlarging of weight and dimensional parameters. The invention solves the problem by using spherical surface provided by toothed grooves and at least two driving pinions according to patent number PV 2010-264 exhibited on 6th April 2010.

Key words

spherical joint, robots, kinematic structure

Introduction

Problem mentioned above is solved by spherical joint with at least two degrees of freedom. Spherical surface is provided at least by one parallel circuit toothed grooves leading to the centre of spherical surface. Toothed grooves are in contact with at least two driving pinions coupled with at least two guiding pinions on the opposite side. This design concept scheme is shown on fig. 1. Rotary pivots, normal to spherical surface, are connected to each pinion. Different design concept equipped with another toothed grooves normal to previous toothed grooves allows another rotary degree (fig. 2).

The main advantage of this solution is in positive dimensional configuration which allows placement of such spherical joint to output parts of manipulator or robot arm. Driving units can be part of pinion or it is possible to use different belt, chain, cable, eventually toothed mechanisms. The wrist with positive dimensional and weight parameters with high motion functionality is obtained.

Designed construction brings increasing of working area of manipulator or robot appliances and decreasing of build-up area, which means wrist construction itself.

Possibilities of spherical joint constructions

The first design construction (fig. 1) is created with spherical surface with one parallel circuit toothed grooves leading to the centre of spherical surface (pos. 3). Toothed grooves are in contact with two driving pinions (pos. 1 and 2) coupled with at least with two guiding pinions (pos. 6 - 9) on the opposite side. This design concept scheme is shown on fig. 1. Rotary pivots (pos. N01 and N02), normal to spherical surface, are connected to each pinion.

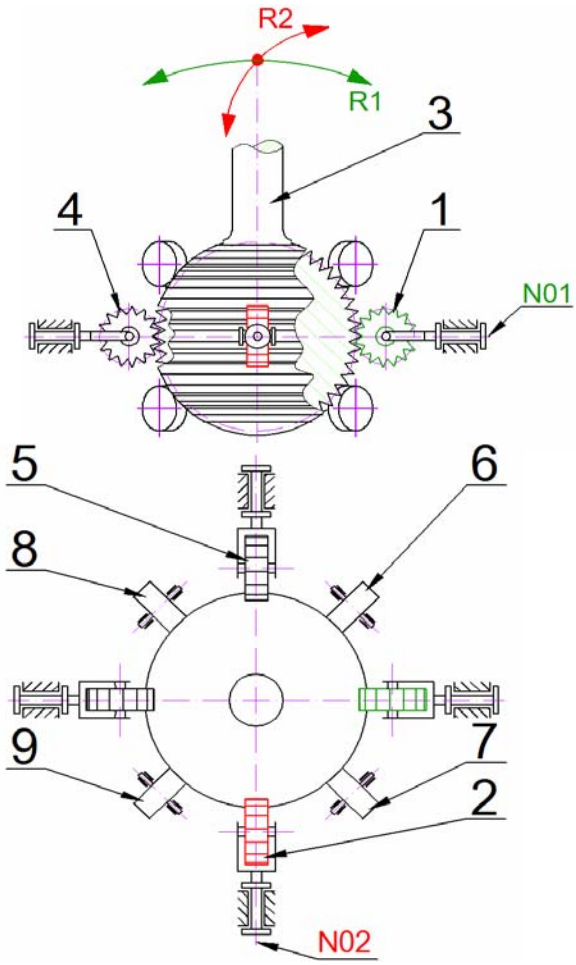

Fig. 1. *Spherical joint with two degrees of freedom*

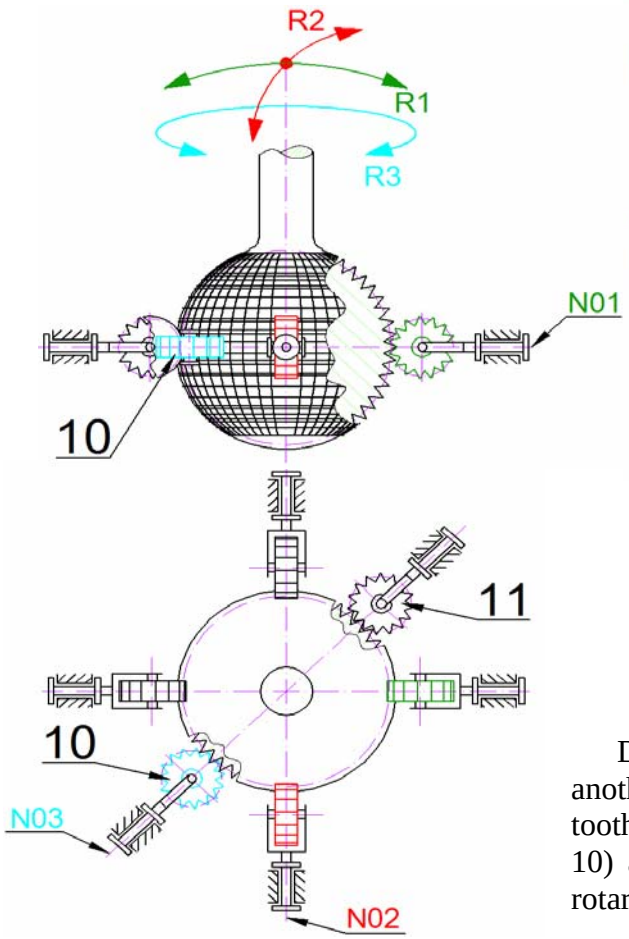

Fig. 2. *Spherical joint with three degrees of freedom*

Different design concept equipped with another toothed grooves normal to previous toothed grooves and third driving pinions (pos. 10) and rotary pivot (pos. N03) allows another rotary degree and is shown on fig. 2.

Designed model with three degrees of freedom

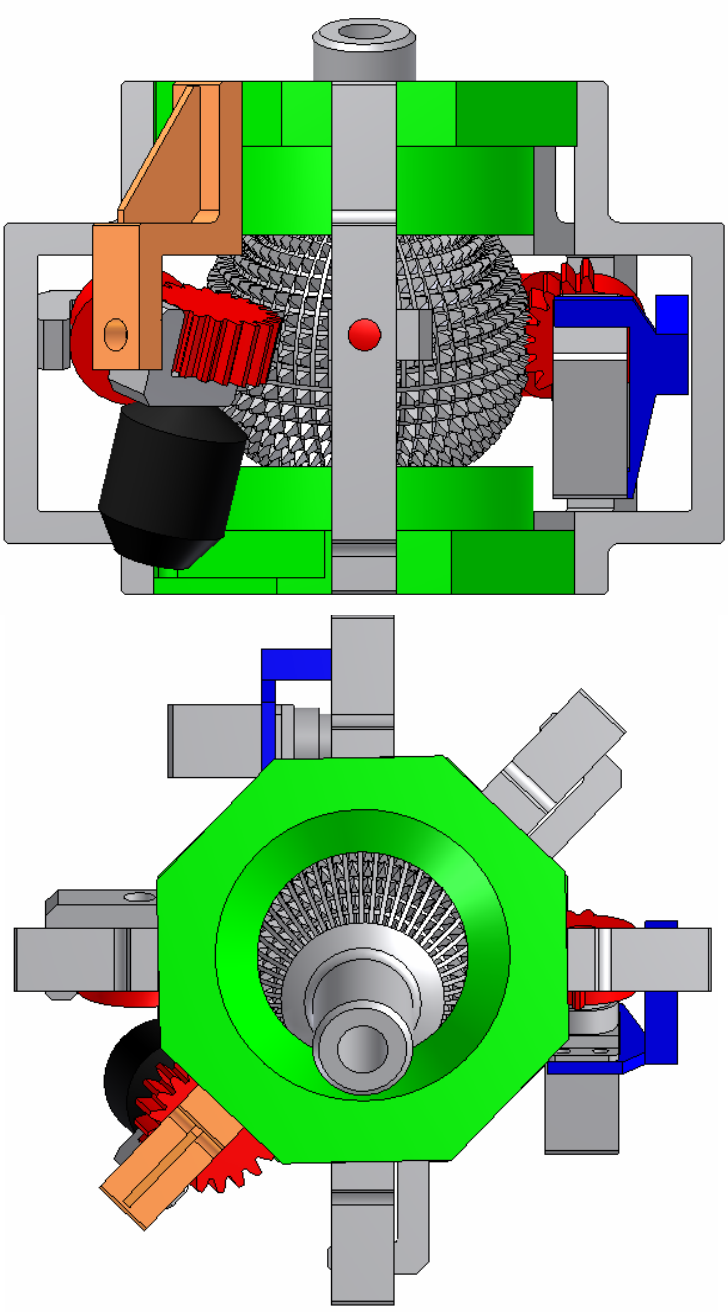

Fig. 3. *Spherical joint with three degrees of freedom*

Designed model on fig. 3 shows spherical joint with three degrees of freedom according to scheme on fig. 2. Toothed sphere joint is placed between two guiding elements made of sliding material. These sliding elements are connected with driving and guiding wheel holders.

Swinging motion R1 and R2 is provided by two servo-electromotors fixed to driving pinions. Third rotary movement R3 is provided by rotary electromotor connected in the same way to driving pinion.

To get construction with smaller build-up area dimensions from top view, it is possible to place appropriate driving motors under toothed sphere and connected them with suitable belt, chain, cable, eventually toothed mechanisms.

Problems of spherical joint motion range in not part of this article and is solving separately. Functionality of this designed model will be experimental proved in upcoming days and results will be published in following contributions.

Conclusion

Spherical joint according to the invention with at least two degrees of freedom seems to find use in major part of recent constructions where the rotary movements are solved separately for reasons of easier driving unit connections. Designed compact construction offers smaller build-up area demands together with decreasing of weight and dimensional parameters. It is also possible to place spherical joint driving units under the spherical joint itself to obtain slimmer construction.