A Study on the fusion reducer module with no-lubrication, high precision for the robot

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Abstract: - The fusion reducer module increases the torque of the motor in the robot system, and converting rotational motion into linear motion or a linear motion to rotational motion. The fusion reducer module part is a robot system to determine the final motion performance. Features of the reducer module for the latest robots are the main influence factors reducer weight directly connected with the base load of the platform for manufacturing the robot. Therefore, it is possible to secure stability of the overall system by giving the weight increase compared to when the reducer module is light weight portable. On the small thin structure reducer module in robotics can ensure a high design flexibility. This study relates to a fusion reducer module for implementing a light weight, thin integrally built-in reducer the development module. The features of the development fusion reducer module is to implement the cycloid or planetary motion in a rotary motion to place a different component in the internal system components to planetary motion and coupled cycloid motion. This paper contains the dynamic Analysis, static Analysis of development reducer module.

Key-Words: - Fusion reducer module, No-lubrication transmission, Dynamic, Static, Analysis, Cycloid

1 Introduction

This development fusion reducer module is easy to apply to thin-lightweight equipment can reduce the installation height because it has a simple structure. It can reduce the use of the complex as a conventional around accessories. The frequency of the maintenance work can be achieved to improve productivity because it significantly reduce than before.

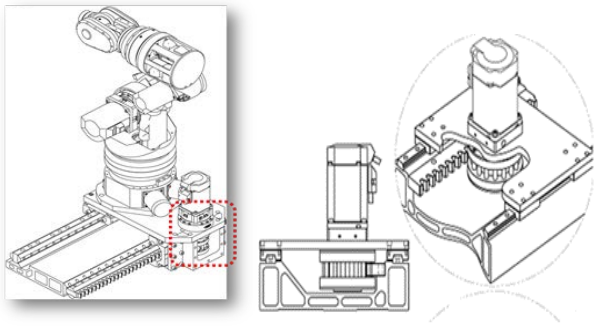


Fig. 1 The fusion reducer module for robot system

The reducer module structure can be reduced because the height of the roller devices has a structure to interact with a rack that is intensive assembly to the main frame. Reducer module has a simplified structure to induce a rotational motion of the rollers relative to each other in association with the power transmission of the planetary gear is positioned within the device.

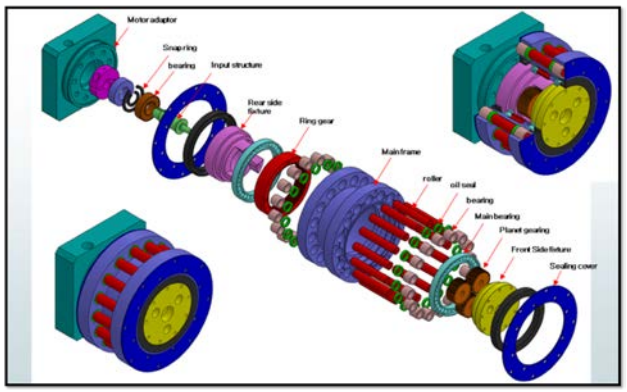


Fig. 2 The fusion reducer module structure

Fig1 and 2 are fusion reducer module for robot system and fusion reducer module structure.
This is fusion reducer module specs of this development.

- Standard length: 640 mm
- Reduction ratio: 1/80
- Rating torque: 40 Nm
- Linear feed speed: 2m/s
- No. of roller: 12 ea
- Pressure angle: 27 deg

2 Dynamic analysis of reducer module

In order to investigate the operability of main core component of the rack and pinion of the fusion reducer module were used to multi-body dynamics Multi-body dynamics is relative motion and the force field of the study of the object in the case of the configuration of one or more objects that movement keeping the mutual relationship.

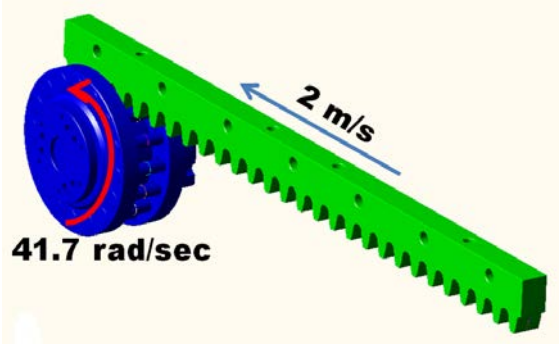


Fig. 3 Multi-body dynamics analysis model

Fig 3 is a multi-body dynamics analysis model for analyzing the dynamic behavior of reducer module rack and pinion. Following figure is the mechanism system of the translation of the rack at a speed 2 m / sec.

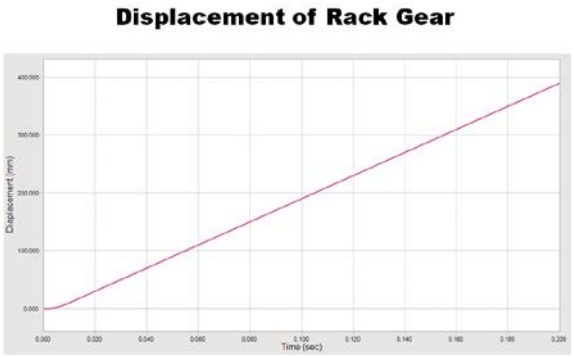


Fig. 4 Analysis result of displacement of rack gear

Fig 4 shows the total distance moved for 0.2 seconds when the rack is moving at a speed of 2m / sec.

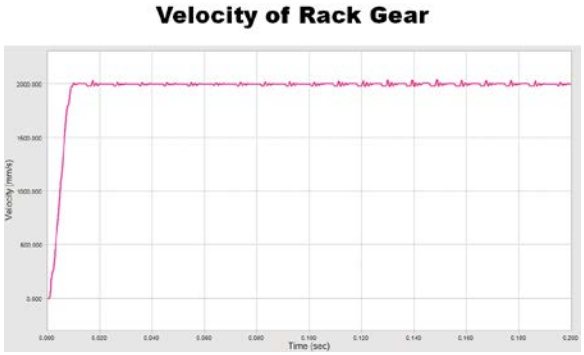


Fig. 5 Analysis result of velocity of rack gear

Fig 5 and 6 shows the moving speed and acceleration for the moving rack for 0.2 seconds. Fig 5 is a rack rate of speed results appear in the 0.2 m / sec. The same output speed and input speed of 0.2 m / sec was calculated. Through this, is was verified reliability of the object dynamics analysis.

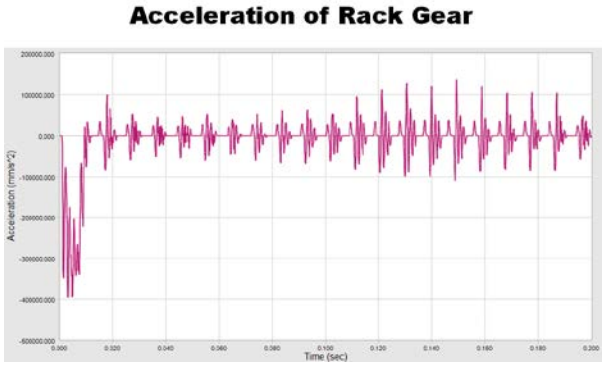


Fig. 6 Analysis result of acceleration of rack gear

Fig 7 and 8 show the pinion angular velocity and angular acceleration . At the same way as in stationary rack to increase the angular velocity it is substantially linearly increased for 0.01 seconds to 42 rad / sec, since the angular velocity is nearly constant.

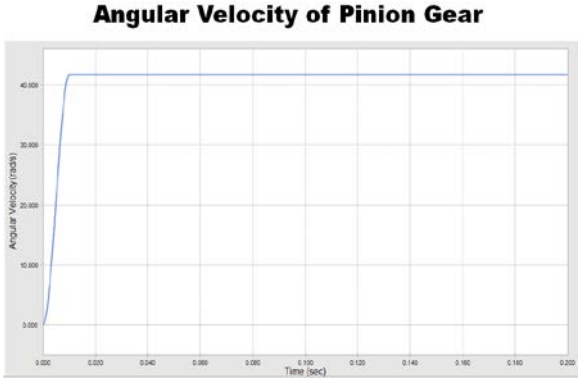


Fig. 7 Analysis result of angular velocity of pinion gear

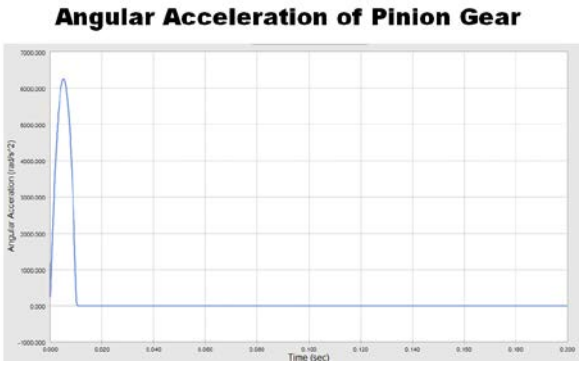


Fig. 8 Analysis result of angular acceleration of pinion gear

Fig 9 shows the amount of torque generated in accordance with rotation of the pinion of the rack at the time of the feed. The initial torque was required in order to rotate the pinion by 0.01 seconds in the stop mode, the no - load state after that it can be seen few torque is then generated.

Fig. 9 Analysis result of driving torque on pinion

Figure 10 shows the amount of force generated in the pitch point of the rack and pinion according to a translation of the rack. The size of the torque moment that is contact force investigated the occurrence of certain changes occur.

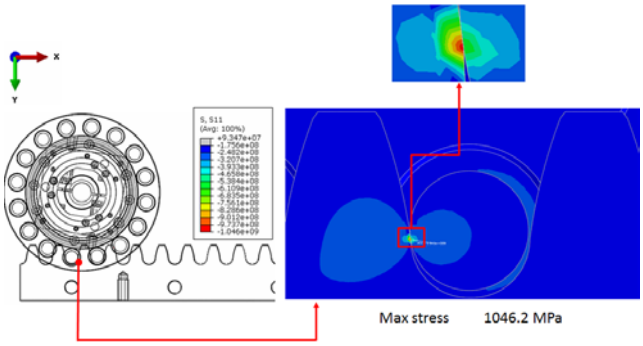
Fig.10 Analysis result of contact force

3 Static analysis of reducer module

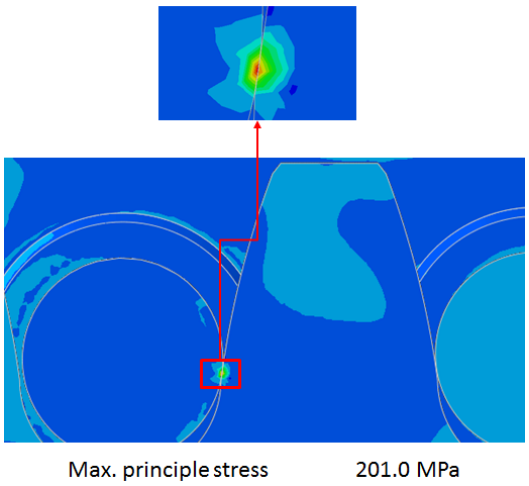
In this study, to find out the strength and rigidity characteristics of the reducer module gear racks and pinion used the finite element method. Finite element analysis was used to calculate the stress in the rack and pinion gear.

Fig. 11 Analysis lattices of rack & pinion

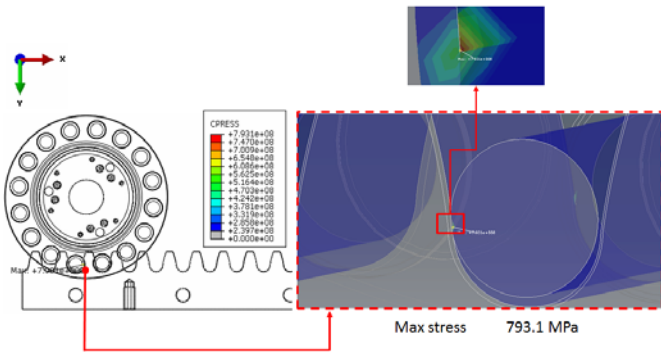
The reducer module design strength of tooth are reviewed mainly on the tooth root bending strength and fatigue strength of tooth contacts. In particular, it is necessary to order to determine the amount of power that is allowed to pass by the value selected for the absolute value of the bending stress .



(a) X- direction stress



(b) Max principle stress



(c) Max contact stress

Fig.12 Analysis results of stress

Fig 12 show the results of calculating the stress generated in the X direction, max principle and max contact. At the analysis results in is rack and pinion has a sufficient strength, it can be seen that satisfies the strength safety of reducer module.

4 Conclusion

This study relates to a fusion reducer module for implementing a light weight, thin integrally built-in reducer the development module. The features of the development fusion reducer module is to implement the cycloid or planetary motion in a rotary motion to place a different component in the internal system components to planetary motion and coupled cycloid motion. This paper contains the dynamic Analysis, static Analysis of development reducer module. In conclusion, it was known the design dynamics and strength of reducer module are adequate design through two analysis.

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