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N. Pavlovic / H.-J. Franke

Adaptronic Revolute Joints for Parallel Robots

INTRODUCTION

Joints for parallel robots are characterized by contradictory requirements in different operating conditions. According to the goal conflicts caused in this way, available passive joint concepts represent an optimal solution with respect to desired clearance and friction performance. The scope of this work is development of adaptive joints for parallel robots which can actively suit different operating conditions. Thereby two different working principles are discussed.

ADAPTRONIC JOINTS BASED ON HIGH-FREQUENCY EXCITATION

This working principle is based on using actuators for generation of high-frequency oscillations which cause friction reduction between the shaft and the bearings in the joint (Fig. 1). The achieved friction reduction in the joint (Fig. 2) is about 30% and the experimental data correspond to the theoretical model [1].

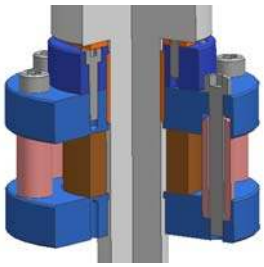


Fig. 1: Axial/radial laboratory joint prototype

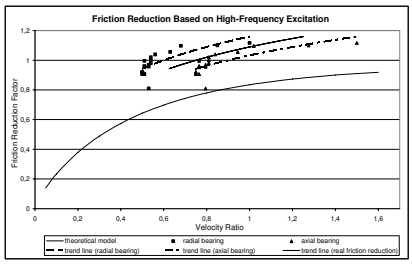
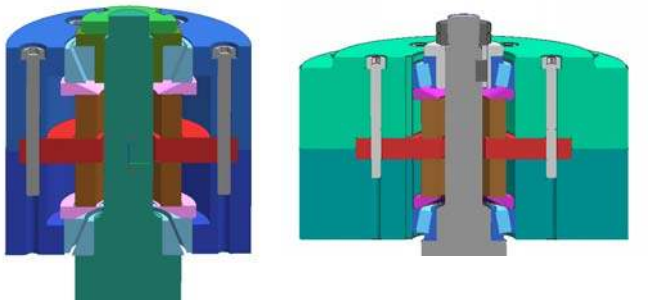


Fig. 2: Friction reduction in the joint

ADAPTRONIC JOINTS BASED ON THE CLEARANCE ADJUSTMENT

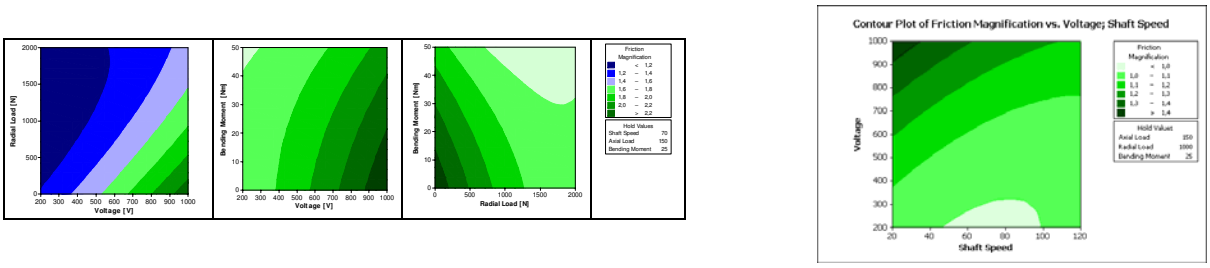
This working principle is based on using actuators for clearance adjustment, so that friction in the joints can be changed according to different operation conditions. Friction changing (magnification) in the joint prototype with integrated plain bearings (Fig. 3a) depends significant on the applied voltage, radial load and bending moment (Fig. 4a). In

the joint prototype with integrated rolling bearings friction magnification depends significant just on the shaft speed and on the applied voltage (Fig. 4b) [2].



(a) (b)

Fig. 3: Joint prototypes with integrated a) plain b) rolling bearings



(a) (b)

Fig. 4: Friction magnification in joint prototypes based on the clearance adjustment

CONCLUSION

Compared to the passive joints, adaptronic joints are able to provide desired clearance and friction performance in different operation modes and improve dynamic and damping performance of parallel robots as well as their accuracy. All this leads to shorter cycle times and therefore to a higher productivity.

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The presented work was funded by the German Research Foundation (DFG) within the framework of the Collaborative Research Centre 562 titled "Robotic Systems for Handling and Assembly – High Dynamic Parallel Structures with Adaptronic Components".

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