ROBOSENSEMOTION

Development of intelligent manufacturing solutions based on an industrial robotic arm with a system of double encoders.

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DESIGN FEATURES

6 d.o.f. robots with double encoders

In each joint robot equipped with a pair of encoders:

1. Internal on the motor side
2. External on the link side.

ROBOSENSEMOTION RSM

EXTERNAL ENCODER

ROBOT JOINT

GEAR BOX

SERVOMOTOR

INTERNAL ENCODER

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DESIGN FEATURES

The developed robot prototype with double encoders (https://youtu.be/S25ak7QizfU) allows indirectly estimate forces applied to the robot by means of elastostatic model. This stiffness model, together with the encoders readings, allows us to estimate the deformations in the gearboxes and in the robot links due to the external forces applied to the robot and compensate their influence in the control loop. This allows us to improve the positioning accuracy of the manipulator during the contact operations, which is important if the robot is used not only in the pick-and-place tasks, but also in grinding and even milling operations.

The proposed algorithms allow us to ensure the positioning accuracy of the robot under the load at a level comparable to robots without external load (parameters usually given in the datasheets).

It is worth mentioning that the proposed technology allows us not only to achieve high positioning accuracy of the robot under the external load, but also makes it collaborative, which expands the range of its application on the production line and saves working space

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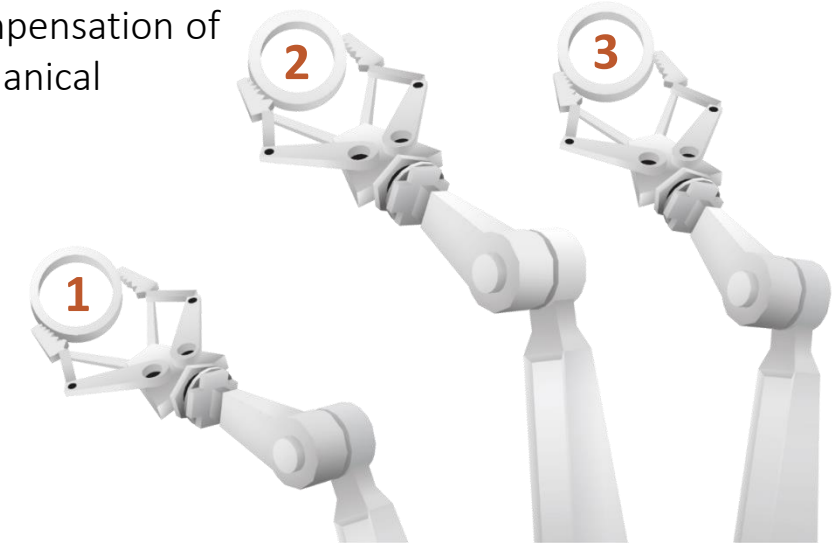
DESIGN FEATURES

To produce a high-precision robot from low-cost components that do not have high accuracy, thanks to online compensation of compliance errors in the mechanical components of the robot.

Realized collaboration possibilities, allowing them to work together with human without harming them.

To estimate directly deformations and identify indirectly applied efforts, thereby increasing the positioning accuracy.



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COMPETITORS AND ADVANTAGES

All industrial robot manicures (Kuka, Fanuc, ABB, etc.) are competitors to this robot. These robots are capable to perform a variety of tasks, including machining.




However, existing solutions do not allow to ensure high accuracy in contact operations. Often, in such operations, the positioning accuracy of the robot can be reduced to a centimeter and below. Standard tools do not allow to compensate positioning errors. The only way in this case is the use of artificial approaches, when we adjust input trajectory taking into account the expected end-effector deflections under external load. This approach requires a number of experiments to obtain stiffness model of the robot and works only for known external loads. If all technical difficulties with additional experimental setups are overcome, then competing robots will at best be able to achieve the same accuracy as our robot, which already integrates the entire complex mathematical apparatus inside. On the other hand, when the applied force to the robot is unknown in advance, the robots from other manufacturers will be unable to compensate compliance errors, while the proposed robot will work just as efficiently as with an external load known in advance.

The competing collaborative robots Kuka IIWA and Universal Robotics are not initially adapted to perform tasks with high effort from the technological process and can only work in the tasks of assembling small products.

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