Measurements in the Force of Robot Grippers – II

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Abstract: The present contribution shows the complete description method of robot grippers force determination when it realize an work operation. A sensor was constructed and coupled in the grippers of the robot with strain-gauge adequated instrumentation. By the system calibration was possible to verify all forces during the manipulation with good sensitivity. At the moment don't exist similar arrangement in robots interprises. The values founded in measurements was compatibles with the theoretical previous in the project of the sensor.

Key words*:* measurements, automation, robots, forces, instrumentation.

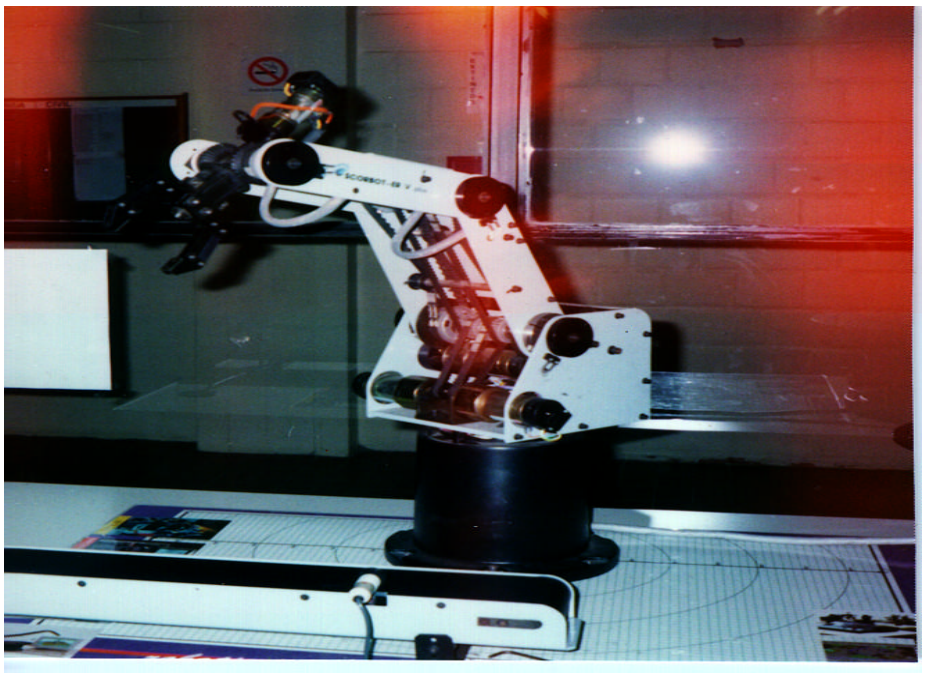

Fig. 1. Shows a robot from Eshed Robotec

1. Degrees of freedom

The motion in a robot can be of a pivoting nature or a reciprocal motion as is produced by a pneumatic or hydraulic cylinder.
In a general manner a robot have six degrees of freedom.
The various degrees of freedom with types of motion determine the physical configuration of the robot (Ray Asfahl, 1992).
During the design process, the engineer may want consider the extent to which changes in systems parameters affect the behavior of a system. In this sense is very important to now the specific forces in the grippers extremity.
In the figure number one, we show the robot utilized for instrumentation.
By the calibration was possible to verify the forces actions during the grippers manipulation with excelent accuracy.

2. Grippers force

For determination the forces surrounded in the grippers was utilized transducers in stell blades in heliptic form with strain gauges in the internal faces. This blades was fixeds in the extremity of the grippers.
The force maked by the grippers is described by the elastics deformations in dependence of geometry and nature of blades used.
The elastics deformations are transformed in electric resistence variations by the strain gauges bonded in the internal part of the blades.
The elastics deformations are very small, therefore is necessary an amplification system with low noise.
The figure number two shows the robot and grippers extremity before the introduction of the sensors with strain gauges couppleds.

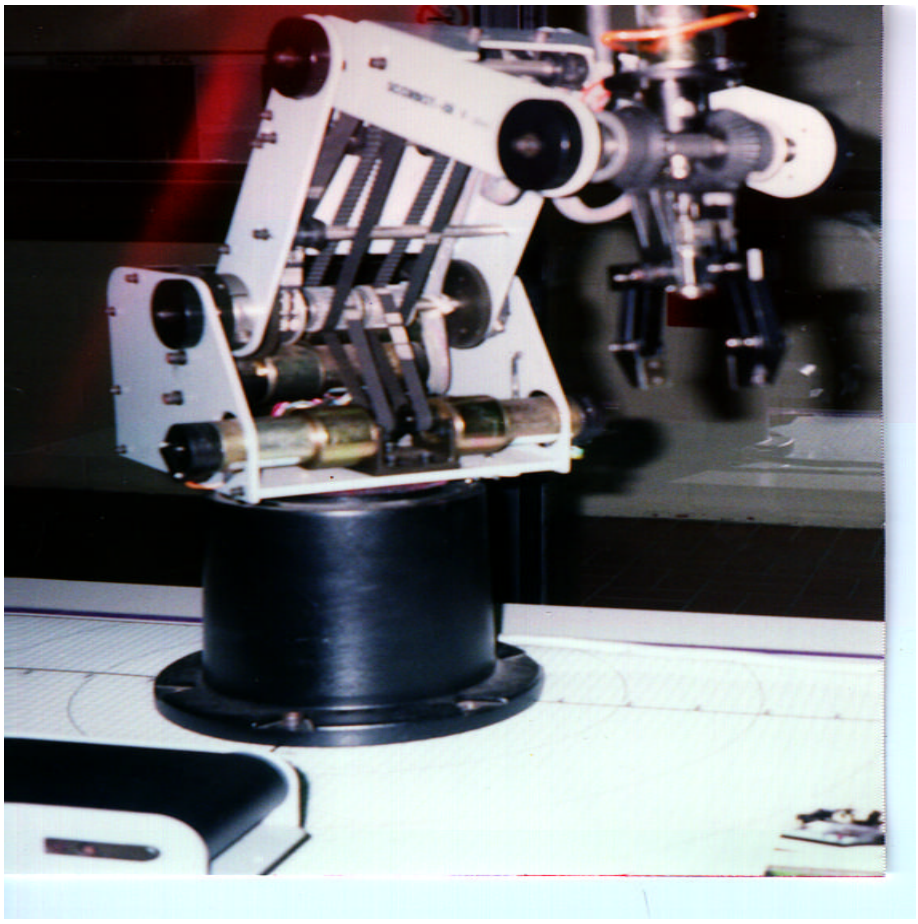

Fig. 2. Shows the grippers extremity.

3. Objectives

In the present contribution we are interested in the construction of the one force sensor with the objective to measure the real force to take place in the robot gripper in all movement realized when it hold an object in the space or make a position transference in this object.

4. Characteristics of equipment

ROBOT: Scorbot ER-V made by the enterprise Eshed Robotec
STRAIN-GAUGES: Electrical Resistence (119,8 ± 0,2) Ω
TEMPERATURE COEFFICIENT: 0,8 ± 0,5% / 100^{o}C
GAUGE FACTOR: 2,12 ± 1%
MANUFACTURER: KIOWA
MATERIAL: FOR STEEL
SENSORS: CONTRUCTED IN STELL

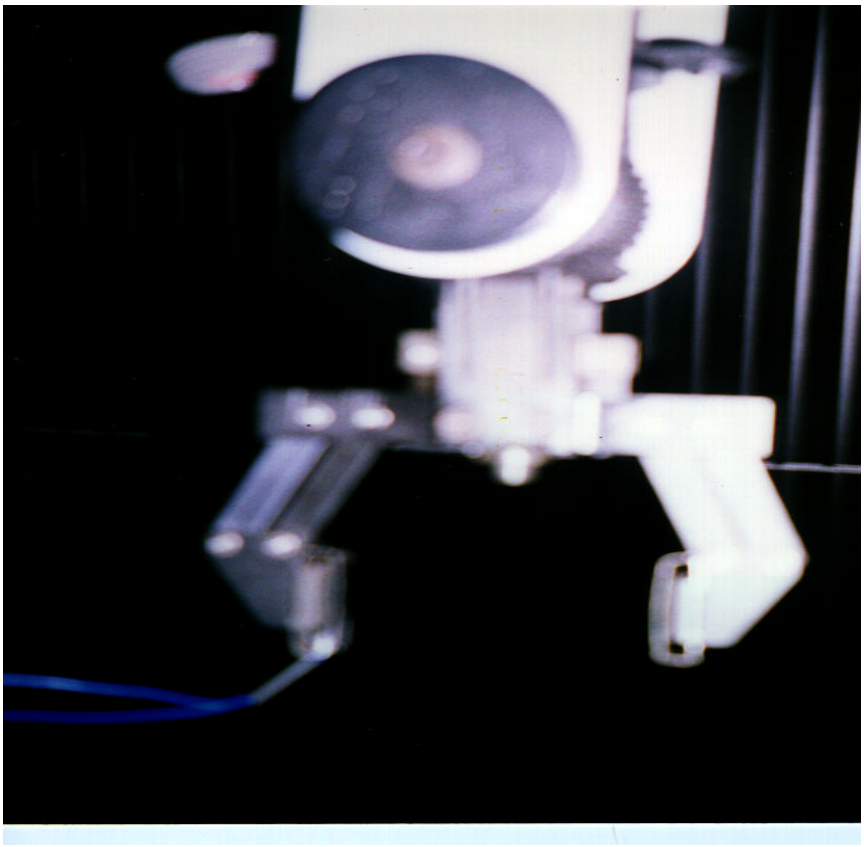

Fig. 3. The grippers with the sensors coupling.

The connetions of strain gauges was made in wheatstone half bridge and in the calibration was used dead weights.

5. Results

With the equipment and arrangements utilized was possible to verify and measure the forces on the extremity of grippers when the robot hold the most different bodies with various geometries and weights.

6. References

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