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A Sensor Component of a Walking Machine's Joint

INTELLIGENT MECHANICS IN ROBOTICS

The sensor for measurement of the robot joint angles proposed in this paper, is an alternative of the well known potentiometric angle encoders, which are frequently used for these purposes. The sensor is realized on the base of magnetic sensitive converter and thoroidal type permanent magnet with variable field with respect to the angular displacement (Fig.1). The precision of the measurements are required to be of 0.25 degrees maximum in the range of 0 to 62 degrees. In the same time, the sensor possesses light construction and easy embedment in the all system.

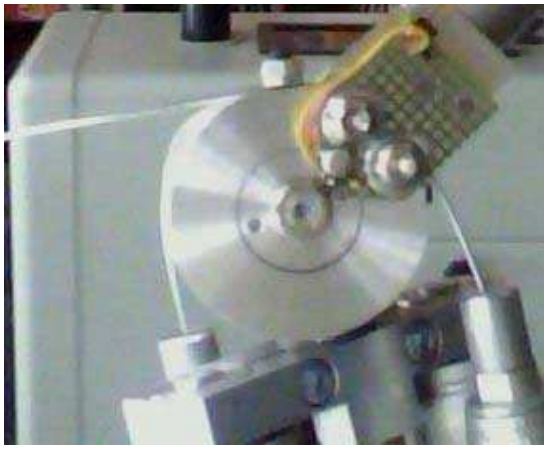

Fig. 1 The joint and the sensor

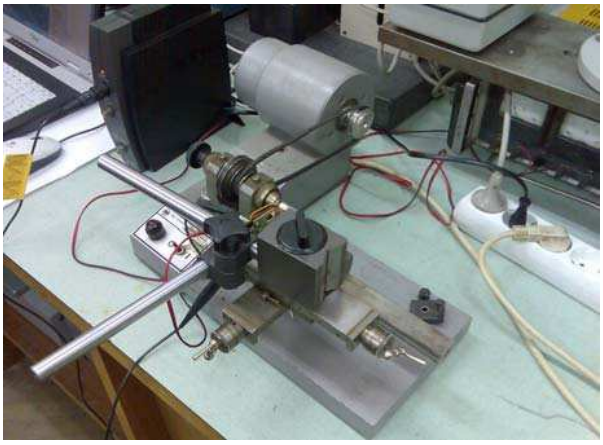

Fig. 2 The stand

Experiments were carried out, in order to determine the optimal operational range (zone) of the sensor (Fig. 2).The supply (feeding, voltage) was chosen to be 5, 7 and 9 volts. Variation of the distance between the magnet and the hall effect element was chosen to be 0.5 mm, 1.0mm, 1.5mm and 2.0mm in the range of the angle variation between 0 and 180 degrees. Some experimental results are depicted in Fig. 3 with step 5 degrees. The linear character of the steady-state characteristic is not influenced by the supply variation. The longest linear sector of the transfer (transmission) characteristic and the least change of the sensitivity are observed when the distance is 1mm. Detailed investigation of the characteristics is performed for operating range of 70 degrees in the

interval between 60 and 135 degrees for the all operating interval with step of one degree.

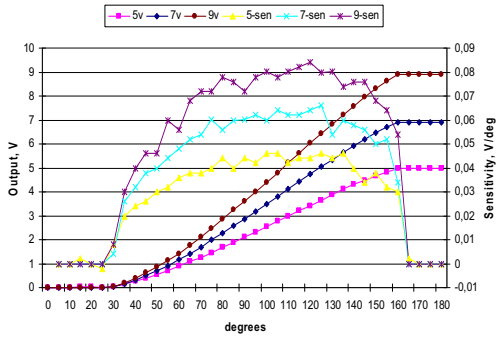

Fig. 3 Steady state characteristic and sensitivity for distance of 1,0mm

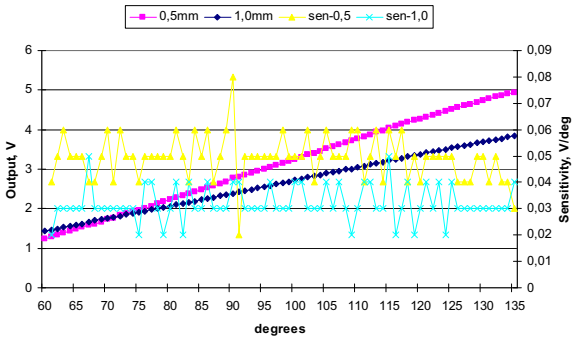

Fig. 4 Steady-state characteristic and sensitivity for distance of 0,5 and 1,0 mm

The results shown in Fig. 4, depict strong linearity in the chosen range and constant sensitivity. Little vacillations in sensitivity can be attributed to random errors which do not change the character of the characteristics. The measured mean square value of the noise voltage σ_u is 2 mV. The experimental results show that the sensitivity of the sensor, in the case of operational conditions described above, is 30 mV/° . When $3\sigma_u$= 6 mV, the minimal angular discrimination is $\psi = \frac{3\sigma_u}{\Delta} = \frac{6\text{mV.grad}}{30\text{mV}} = 0{,}2 \text{ grad}$. In the range of 62 degrees for normal joint operation, a 8 bits (62/0,25 =248) A/D converter is needed.

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