

SENSATION MODEL OF AN ANTHROPOMORPHIC MANIPULATOR FOR ROBOTIC SYSTEMS

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This article describes the task of sensing of an anthropomorphic manipulator for robotic systems in order to control the position of individual robot parts relative to each other. The structure of the proprioception system of the manipulator based on resistive flex sensors is described, as well as the connection diagram of the sensors to an analog-to-digital converter that collects data on the position of individual robot parts. In addition, a number of experiments were conducted to assess the linearity of the sensors output signal. It was found that the flex sensor has a different relationship for positive and negative bend angles. The resistance changes markedly when the sensor is bent (positive values of the bending angle), and the dependence is close to linear. And with negative values of the bending angle, the changes in resistance are insignificant. To sense the manipulator in the form of a human brush based on such a system, it is necessary to use 20 bend sensors.

Keywords: flexible sensor, manipulators, anthropomorphic robots.

REFERENCES

1. *Osnovy psikhofiziologii* [Fundamentals of Psychophysiology]: Textbook / YU.I. Aleksandrov. M.: INFRA-M, 1997.
2. Deykalo V.P. *Klinicheskaya anatomiya kisti i khirurgicheskiye dostupy* [Clinical anatomy of the hand and surgical access]: Textbook / V.P. Deykalo, A.N. Tolstik, K.B. Boloboshko. Vitebsk: VGMU, 2013. 123 p.
3. Kolyubin S.A. *Dinamika robototekhnicheskikh sistem* [The dynamics of robotic systems]: Textbook / SPb.: ITMO University, 2017. 117 p.
4. Kotyuk A. F. *Datchiki v sovremennykh izmereniyakh* [Sensors in modern measurements]. M.: Radio i svyaz, Goryachaya liniya - Telekom, 2006. 96 p. (Massovaya radio-biblioteka. V. 1277).
5. L.B. Bridgwater, C.A. Ihrke, M.A. Diftler, M.E. Abdallah, N.A. Radford, J.M. Rogers, S. Yayathi, R.S. Askew, D. M. Linn The Robonaut 2 Hand – Designed To Do Work With Tools // 2012 IEEE International Conference on Robotics and Automation - Robots and Automation: Innovation for Tomorrow's Needs; May 14, 2012 - May 18, 2012; St. Paul, MN; United States
6. J. Butterfaß, M. Fischer, M. Grebenstein, S. Haidacher, G. Hirzinger Design and experiences with DLR HAND II // World Automation Congress Tenth International Symposium on Robotics with Applications, Seville, Spain. June 28th-July 1st. 2004.
7. Yu She, Sandra Q. Liu, Peiyu Yu, Edward Adelson Exoskeleton-covered soft finger with vision-based proprioception and exteroception // arXiv:1910.01287v1 [cs.RO] 3 Oct 2019.
8. Leskov A.G., Bazhinova K.V. Sistema planirovaniya i otsenki zakhvata ob"yektov manipulya-robotom [System for planning and evaluating the capture of objects by manipulator-robot] // Proceedings of the International Scientific and Technological Conference, Extreme Robotics. St. Petersburg. 2016. Pp. 291-295.
9. FS-L-0055-253-ST Spectrasymbol resistive flex sensors datasheet URL: <https://www.spectrasymbol.com/wp-content/uploads/2019/07/flexsensordatasheetv2019revA.pdf>.

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