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# Electromyography data application in control systems of exoskeleton devices

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*The article considers the information systems on the basis of electromyography (EMG). The purpose of multilevel structure processing EMG signals is to collect the information from the movement of the wrist joint and define the type of motion with the use of a classifier based on fuzzy logic. Classifier type movements of the wrist joint showed high accuracy (probability) recognition up to 93 % in real-time. The structure of the hardware and software system for data analysis electromyography and algorithms for the detection of movements can be used for both laboratory research and for prototyping systems exoskeleton biofeedback devices.*

**Keywords:** *fuzzy logic, electromyography, pattern recognition, biofeedback, prototyping, exoskeleton device*

## REFERENCES

- [1] Andrianov D.A., Gavrilov A.I. *Molodezhny nauchno-tekhichesky vestnik — Youth Scientific and Technical Bulletin*, 2012, no. 3. Available at: <http://sntbul.bmstu.ru/doc/458150.html> (accessed December 4, 2014).
  - [2] Zenkevich S.L., Yushchenko A.S. *Osnovy upravleniya manipulyatsionnymi robotami* [Fundamentals of manipulation robots]. 2nd ed. Moscow, BMSTU Publ., 2004, 480 p.
  - [3] Siti A.A., Asnor J.I., Sawal A. Classification of surface electromyographic signal using fuzzy logic for prosthesis control. *Proc. of IEEE EMBS Conference on biomedical engineering and science*, 2010, pp. 471–474.
  - [4] Ryait H.S., Arora A.S., Agarwal R. *Journal of Electromyography and Kinesiology*, 2011, vol. 21, no. 10, pp. 868–876.
  - [5] Zecca M., Micera S., Carrozza M.C., Dairo P. *Critical reviews in biomedical engineering*, 2002, no. 30, pp. 459–485.
  - [6] Gavrilov A.I., Soe Soe Thaw Oo. *Vestnik MGTU im. N.E. Baumana. Ser. Priborostroenie — Herald of the Bauman Moscow State Technical University. Series Instrument Engineering*, 2016, no. 6, pp. 71–84.
  - [7] Soe Soe Thaw Oo, Gavrilov A.I., Andrianov D.A., Gavrilov A.I. *Molodezhny nauchno-tekhichesky vestnik — Youth Scientific and Technical Bulletin*, 2015, no. 11. Available at: <http://sntbul.bmstu.ru/doc/817650.html> (accessed September 7, 2015).
  - [8] Suranov A.Ya. *LabVIEW Spravochnik po funktsiyam* [LabVIEW Handbook of Functions]. Moscow, DMK Press Publ., 2007, 536 p.
  - [9] Fraiwan L., Awwad M., Mahdawi M., Jamous Sh. Real time virtual prosthetic hand controlled using EMG signals. *Biomedical engineering (MEME)*, 2011, pp. 225–227.
  - [10] Zade L.A. *Ponyatie lingvisticheskoy peremennoy i ego primeneniye k prinyatiyu priblizhennykh resheniy* [The concept of a linguistic variable and its application to the adoption of approximate solutions]. Moscow, Mir Publ., 1976, 165 p.
  - [11] Zade L.A. *Osnovy novogo podkhoda k analizu slozhnykh sistem i protsessov prinyatiya resheniy* [Basics of a new approach to the analysis of complex systems and decision-making processes]. *Matematika segodnya. Sbornik statey* [Mathematics today. Collected Articles]. Moscow, Znanie Publ., 1974, pp. 5–49.
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