

Michał CICHOWICZ¹, Marcin WARDACH¹, Paweł HERBIN², Ryszard PAŁKA¹

Zachodniopomorski Uniwersytet Technologiczny w Szczecinie, Wydział Elektryczny, Katedra Maszyn i Napędów Elektrycznych (1)
Politechnika Morska w Szczecinie, Wydział Mechatroniki i Elektrotechniki, Katedra Robotyki i Sterowania (2)

Biomechanical devices – electric machines, mechanical designs and control methods: a review of current developments

Abstract: In this paper a review of current solutions used in biomechanical devices is presented. The most attention would be paid on electrical motors, mechanical skeletons and methods of control them.

Keywords: electrical machines, biomechanical constructions, control algorithms, exoskeleton, humanoid robot

High Torque Electrical Machines used to drive biomechanical devices

Many of the biomechanical devices contain electrical machines for very different usage. The most common machines are the servo motors, hence closed drive systems composed of direct current (DC) motor or brushless direct current motor (BLDC) with ready implemented encoder. The servomotor rotates, causing feedback pulses to be sent from the encoder to the servo amplifier. The deviation counter subtracts the feedback pulses from the encoder from the command pulses from the positioning module. The pulses counted by the deviation counter are called error pulses.

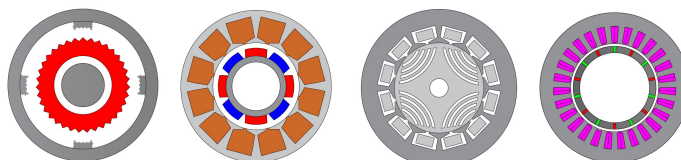


Fig.1. High Torque electric machines: (from left hand side) stepper motor, PMSM, SynRel, PMVM.

Based on the literature review (165 articles mentioned in the paper), it was found that the largest number of motors used in bionic designs are BLDC motors (23), servo motors (30), DC motors (13), various high-torque motors (10) and PMSM motors (30). Stepper motors (3) are the most commonly used. Furthermore, considering the other high torque motors, it was found that SynRel (2), FSPM (2), PMVM (5), SRM (3), YASA (1), CPFRM (2), AFPM (4), linear (3) or induction (2) motors are described in the literature. The article contains a description of the individual types of machines and their comparison.

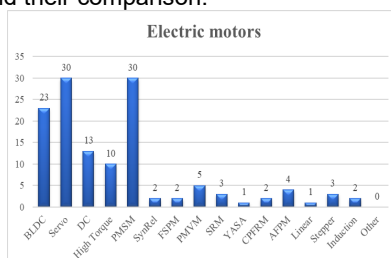


Fig.2. Type of motors with high torque which are used in biomechanical constructions

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Authors: mgr inż. Michał Cichowicz, West Pomeranian University of Technology, Szczecin, Sikorskiego 37, 70-313 Szczecin, e-mail. michal.cichowicz@zut.edu.pl; dr hab. inż. Marcin Wardach, prof. ZUT, West Pomeranian University of Technology, Szczecin, Sikorskiego 37, 70-313 Szczecin, e-mail. marcin.wardach@zut.edu.pl; dr inż. Paweł Herbin, Maritime University of Szczecin, Wały Chrobrego 1/2, 70-500 Szczecin, e-mail. p.herbin@pm.szczecin.pl; prof. dr hab. inż. Ryszard Pałka, West Pomeranian University of Technology, Szczecin, Sikorskiego 37, 70-313 Szczecin, e-mail. ryszard.palka@zut.edu.pl