INVESTIGATION OF ACTUATOR DYNAMICS FOR AN EXOSKELETON, TAKING SUPPORT CONTACT FORCES INTO ACCOUNT

Zh.N. Isabekov   janibek_23.93@mail.ru

Bauman Moscow State Technical University, Moscow, Russian Federation

Abstract	Keywords
We consider a kinematic diagram of a tree-like actuator for an exoskeleton. We used the D'Alembert's principle to derive the equations of dynamics. We present the results of investigating dynamics of an exoskeleton actuator. We developed a 3D model of the exoskeleton actuator using the SolidWorks software package. We used the MATLAB software package to plot torque and power inside the joints as functions of time.	 © Bauman Moscow State Technical University, 2017

References

[1] Medvedev V.S., Leskov A.G., Yushchenko A.S., Popov E.P., ed. Sistemy upravleniya manipulyatsionnykh robotov [Control systems of manipulation robots]. Moscow, Nauka publ., 1978, 416 p.

[2] Koval'chuk A.K. Modified Denavit-Hartenberg coordinate system for robot actuating mechanisms with tree-like kinematic structure. *Nauka i obrazovanie. MGTU im. N.E. Baumana* [Science and Education. BMSTU], 2015, no. 11, pp. 12–30. Available at: http://technomag.bmstu.ru/doc/826673.html (accessed 10.06.2017).

[3] Isabekov Zh.N. Kinematic diagram engineering of tree-like exoskeleton actuating mechanism in Bauman MSTU. *Molodezhnyy nauchno-tekhnicheskiy vestnik*, 2016, no. 11. Available at: http://sntbul.bmstu.ru/doc/851261.html.

[4] Zenkevich S.L., Yushchenko A.S. Osnovy upravleniya manipulyatsionnymi robotami [Basic concepts of manipulation robots control]. Moscow, Bauman Press, 2004, 480 p.

[5] Isabekov Zh.N. Mathematical model of kinematics and dynamics of powered exoskeleton tree actuator. *Politekhnicheskiy molodezhnyy zhurnal* [Politechnical student journal], 2016, no. 11. Available at: http://ptsj.ru/catalog/menms/robots/34.html.

[6] Vereykin A.A., Koval'chuk A.K., Karginov L.A. The lower extremities exoskeleton actuator dynamics research taking into account support reaction. *Nauka i obrazovanie. MGTU im. N.E. Baumana* [Science and Education. BMSTU], 2014, no. 12, pp. 256–278. Available at: http://technomag.bmstu.ru/doc/745388.html (accessed 10.06.2017).

[7] Koval'chuk A.K., ed. Osnovy teorii ispolnitel'nykh mekhanizmov shagayushchikh robotov [Theory fundamentals of walking robot actuating mechanism]. Moscow, Rudomino publ., 2010, 167 p.

[8] Koval'chuk A.K., Yarots V.V. Designing actuating mechanism of robot and power calculation of task rectangular drive. *Estestvennye i tekhnicheskie nauki* [Natural and technical sciences], 2016, no. 10, pp. 101–106.

[9] Koval'chuk A.K. Power calculation of robot drive taking into account its actuating mechanism dynamics. *Estestvennye i tekhnicheskie nauki* [Natural and technical sciences], 2014, no. 1, pp. 128–131.

[10] Koval'chuk A.K., Vereykin A.A., Karginov L.A., Tsepkova A.A. Designing and calculation of medical robot drives taking into account its actuating mechanism dynamics. *Tekhnika i tekhnologiya: novye perspektivy razvitiya*, 2014, no. XII, pp. 28–41.

[11] Koval'chuk A.K., Romashko A.M., Vereykin A.A., Karginov L.A., Malyakina E.A., Stativa V.A. Moments identification in six-leg walking robot articulation. *Teoreticheskie i prikladnye aspekty sovremennoy nauki*, 2014, no. 3-1, p. 78–85.

[12] Vereykin A.A., Koval'chuk A.K., Kulakov D.B., Semenov S.E. Analysis and Choice of the Exoskeleton's Actuator Kinematic Structure. *Nauka i obrazovanie. MGTU im. N.E. Baumana* [Science and Education. BMSTU], 2014, no. 7, pp. 72–93. Available at: http://technomag.bmstu.ru/doc/717676.html (accessed 10.06.2017).

[13] Kugul'tinov S.D., Koval'chuk A.K., Portnov I.I. Tekhnologiya obrabotki konstruktsionnykh materialov [Optimization of construction materials technology]. Moscow, Bauman Press, 2008, 678 p.

Isabekov Zh.N. — Master's degree student, Department of Fluid Mechanics, Hydraulic Machines and Hydraulic and Pneumatic Automation, Bauman Moscow State Technical University, Moscow, Russian Federation.

Scientific advisor — A.K. Kovalchuk, Cand. Sc. (Eng.), Assoc. Professor, Department of Fluid Mechanics, Hydraulic Machines and Hydraulic and Pneumatic Automation, Bauman Moscow State Technical University, Moscow, Russian Federation.