15th INTERNATIONAL CONFERENCE
Dynamical Systems — Theory and Applications
December 2-5, 2019. Lodz, POLAND.

DSTA 2019

paper id: LIF315

Modelling and control of a lower limb exoskeleton driven by linear actuators

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Abstract: This paper presents novel design of a lower limb exoskeleton driven by linear electric actuators. To better investigate the crucial kinematic parameters of the device, we created a general, three-dimensional simulation model of the studied exoskeleton in Mathematica software. Both in the presented design and the developed simulation model, biocompatibility aspects of the simulated walking machines were also considered. As the articulated variables in the individual joints of the exoskeleton, we employed time histories of human joint angles obtained by a motion capture system. A new gait generator was developed and tested. It can be used to produce rhythmic movements in hip and knee joints. Finally, we verified the possibility of implementing the proposed control method by using the constructed prototype of a single limb of an exoskeleton, controlled by a popular Arduino Uno microcontroller. The carried out experimental tests gave promising results regarding the applied control possibilities.

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