

In the doctoral dissertation of N.T. Zhetenbayev, the development of a wearable device designed for the rehabilitation of the ankle joint. This device includes a control system based on an electric linear actuator. From a scientific point of view, the main purpose of this research and development is to meet the rehabilitation needs of people recovering from ankle injuries. The electric linear actuator is a key component responsible for controlling and strengthening the necessary movements, which are an integral part of the rehabilitation process, while providing support for the ankle joint. This study is focused on the study of technical subtleties, biomechanical principles, and clinical application of this exoskeleton for the ankle joint.

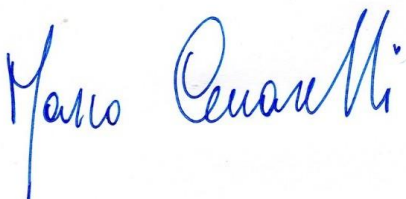
Validation of the methodologies used in this doctoral study is of paramount importance to substantiate the practical usefulness of the ankle exoskeleton for mitigating health-related problems. The electric linear actuator provides precise control of the range and speed of movements in the ankle joint. Such precision is necessary to adapt rehabilitation exercises to the unique requirements of individuals and their respective phases of recovery.

This device provides invaluable assistance to people with limited mobility, facilitating the exercise regime and restoring the functional use of the ankle joint. This ensures that rehabilitation exercises are performed in proper form and within a safe range of movements, thereby reducing the likelihood of repeated injuries during rehabilitation. In addition, the device optimizes the rehabilitation protocol, effectively affecting the main movements and muscle groups, which potentially leads to a reduction in the overall duration of the rehabilitation process.

Zhetenbayev Nursultan's dissertation is the culmination of extensive research that lasted several years devoted to the development of an ankle exoskeleton using artificial muscles. Throughout the work on this dissertation, the author demonstrated a high degree of scientific maturity and showed noticeable independence in choosing and solving scientific problems.

Zhetenbayev Nursultan doctoral work, titled «Design of the exoskeleton of ankle joint with artificial muscles», attains a commendable level of scientific excellence. It displays internal cohesion, offers theoretical and practical significance, and aligns with the prerequisites for dissertations leading to the Doctor of Philosophy (PhD) degree within the field of specialization, namely 6D071600 – «Instrument Making». The author is duly deserving of the conferment of a doctoral degree in this domain.

*Marco Ceccarelli professor of Mechanics of Machinery, direttore di LARM2: Laboratory of Robot Mechatronics of the Department of «Industrial Engineering» (<http://www.larmlaboratory.net/ceccarelli.html>)*



prof. Marco Ceccarelli Roma, 25 september 2023